Attachment 1

Plan of Operation

GENERAL FACILITY DESCRIPTION, RELATIONSHIP TO COUNTY, SOLID WASTE PLAN, AND OWNERSHIP

The Bountiful Sanitary Landfill (Previously called the Bay Area Refuse Disposal site (BARD)) occupies approximately 150 acres on the east shore of the Great Salt Lake, west of West Bountiful, Utah. The landfill began receiving municipal waste in about 1962, while it was operated by a group of six east shore cities, and Davis County which constituted the Bay Area Refuse Disposal District. The Bay Area Refuse Disposal District consisted of the following public entities:

1. Bountiful City
2. Centerville City
3. Farmington City
4. City of North Salt Lake
5. West Bountiful City
6. Woods Cross City
7. Davis County (unincorporated areas)

Starting July 1987, all of the public entities except Bountiful joined the Davis County Solid Waste Management District and began transferring their refuse to the Davis County "Burn Plant" near Hill Air Force Base in North Davis County. Since that time the landfill has been operated solely by the City of Bountiful.

Use of the facility is limited to residents of the City of Bountiful. The landfill receives residential and commercial wastes and construction debris produced within Bountiful City, which has a total area of nearly 13 square miles (Population 45,762 as of 2020 Census). Hazardous wastes, asbestos, waste tires, and PCB contaminated wastes are prohibited.

The property upon which the landfill is located is owned by the City of Bountiful, and is located in the North 1/2 Sec. 14 T. 2 N. R. 1 W. SLB&M. The front gate is located at latitude 40º54'30" and Longitude 111º55'00". Proof of ownership is attached in appendix A.

PLAN OF OPERATION

Schedule of Construction

Upgrading and implementation of operational changes at the Bountiful Sanitary Landfill began in 1987 when Bountiful City became sole owner and operator of the facility. These changes were the beginning of the process required in order to come into compliance with State of Utah Solid Waste Permitting and Management Rules. Barton/Stone Creek, which prior to 1992 was unlined and traversed the south portion of the landfill, was realigned and concrete lined in an attempt to isolate refuse from surface and ground water. A large pond was also excavated south and west of the landfill that serves several purposes. One of the important purposes was to obtain low permeability clay cover material to use at the landfill. Much of the soil excavated was used to re-contour the south half and the east side of the north half of the landfill to promote runoff and reduce infiltration into the refuse. This cover soil reaches fourteen feet thick in some areas. Current plans are to excavate cells from this cover and continue filling refuse in these areas when the fill plan progresses to that point.

In spring of 1996, landfill personnel completed the excavation and lining of the runoff retention/evaporation pond to retain runoff of storm water from the active face of the landfill during a 24-hour 25 year intensity storm. Landfilling is being accomplished in a manner such that the working face and surrounding areas drain toward the pond in order to retain any runoff from the active face within the pond.

Additional upgrades at the site include implementation and enlarging the recycling program at the landfill site to complement the current recycling program operated by the City of Bountiful. Bins have been placed where recyclable materials can be deposited. Steel, aluminum, batteries, carpet pad (urethane), and e-waste are all recycled.

As a means of waste reduction the city has also implemented operations to reduce the amount of yard waste deposited in the landfill. In 1996 the City began to produce and stockpile wood chips from tree limbs and branches delivered to the landfill for disposal. These chips are useful for various public and private projects, including disease vector control and daily cover at the landfill. This program has developed into a composting program using the excess wood chips along with other yard waste delivered to the landfill to produce high quality mulch which is sold back to the public.

The 1996 site improvements included a new scale, scale house, operations center/office building, and a new equipment storage building at the landfill site. In order to accommodate the Legacy Parkway project, the portion of the property occupying these improvements was sold to the Utah Department of Transportation. These facilities were demolished and replaced with new facilities that were completed in 2007. Culinary water, natural gas, power, phone lines, and sanitary sewer service the facility.

A layout of the site improvements is included in Appendix B.

Fill Plan

This fill plan was developed in an attempt to provide the most efficient use of landfill space and available cover material by making haul distances as short as possible. The fill plan is divided into four major phases. These phases are briefly described as follows:

> **Phase I**. This is the area that was currently being filled with refuse at the time of the initial permit application in October 1994. As indicated on the figure in Appendix B, it is located near the center and west end of the north half of the landfill. Quantity and volume calculations indicated that this phase had a life of approximately 2.5 years beginning fall of 1994. This phase was completed around the end of 1996.

Phase II. This is the area currently being filled. This phase will attempt to make maximum use of the entire north half of the landfill. As indicated on the drawings in Appendix B, fill began at approximately elevation 4220 (NGVD29), and will continue to progress in an orderly manner across the phase. Fill will progress in an area fill manner, in lifts approximately 10 feet thick. Grading will provide drainage away from the active face and toward the run-off retention pond. Each lift will be well compacted, and receive daily cover. Any fill area that remains inactive for 30 days will receive additional cover for a minimum of 12" intermediate cover. The intermediate cover will be monitored for erosion on a regular basis as part of the regular maintenance and monitoring activities at the landfill. Upon completion of this phase, side slopes will be up to thirty-thee percent on all sides of the north half of the landfill. The north, east, and west slopes of the north half of the landfill will receive final cover, topsoil, and re-vegetation. When Phase II is completed, much of the final cover, topsoil, and vegetation will be in place and prepared for eventual closure.

Phase III. This phase will be very similar to phase II, but will be performed on the south half of the landfill. The main difference will be that the south half currently has excess cover material, (up to 14 feet thick) which will be excavated and stockpiled for use as cover on the landfill. The first lift will resemble a trench fill procedure as the excess cover material is reclaimed. After the excess clay cover is excavated, and the first lift is placed, subsequent lifts will be placed in an area fill manner. Upon completion of this phase, side slopes will be at up to thirty-three percent. The south, east, and west slopes will have final cover, topsoil, and be re-vegetated as the fill is being placed.

Phase IV. This will be the final phase of refuse fill at the site. In this phase the center "valley" between phase II and phase III will be filled. In order to provide drainage toward the retention pond, fill will begin on the east end of the valley and will progress toward the west in an area fill manner with lifts of between five and ten feet thick. Access to the working face will be provided by traversing the north half of the landfill and approaching the working face from the west. Fill on the east end of the phase will slope at thirty-three percent to match the slopes on the east side of phases II and III. As fill is placed, final cover, top soil, and re-vegetation will be ongoing.

Volume surveys performed over the last several years have found that the landfill is achieving waste-in-place density of at least 1550 lb/cy, after the waste has been in place for some time and allowed to settle. This is the density used for projections of how long landfill cells will last. Quantity and volume calculations indicate that Phase II will be completely filled in about year 2043. Phase III has a life of approximately 25 years, and Phase IV has a life of approximately 12 years. Based on the conclusions from the Remaining Life Study with current waste disposal rates and practices, it has been calculated that the landfill's life will end in approximately year 2080. However, small changes in variables involved in calculating landfill life can make it nearly impossible to anticipate capacity over that long of a time frame. The Remaining Life Study is included in Appendix C.

Solid Waste Handling Procedures

As solid waste is transported onto the site, the transport vehicle must pass the scale house. Every commercial load of refuse delivered to the site will be weighed to determine the weight of refuse deposited. In addition, all construction and demolition waste is weighed regardless of the hauler. Individual private citizens hauling municipal solid waste (pick-up trucks) are charged a uniform fee and the tonnage is estimated based on a calculated average weight. This information will be recorded using a computer database that will report on the ticket and various forms as shown in Appendix D. The database and reports will be retained in landfill records. The scale house operator will be trained to recognize potential hazardous waste and will question the transporter as to the origin of the wastes to be deposited. All suspicious loads will be inspected by trained personnel, and if determined to contain any excluded material will not be allowed to unload at the landfill. At least one percent of all loads delivered to the landfill will be inspected at random. For more information on load inspections, see the section below, "Load Inspection". Any recyclable materials will be separated by the transporter and deposited in the recycling bins prior to progressing to the working face of the landfill for disposal. Transporters hauling yard clippings and tree limbs will be directed to the composting area for unloading.

Unloading and systematic placement of refuse, restricted to a small unloading area and coordinated with spreading and compacting operations, reduces work, minimizes scattering of refuse, and expedites unloading of collection vehicles. Therefore, the following are performed at the landfill:

a. Appropriate signs are posted to indicate clearly where vehicles are to unload.

b. An attendant is on duty near the working face during operating hours to direct unloading of refuse.

c. Unloading of refuse is confined to as small of an area as possible.

d. A maximum of two small working faces will be active at the landfill. This will be to expedite unloading of vehicles hauling refuse and to separate commercial and private hauling vehicles.

Spreading and compacting the refuse is accomplished by incorporating the following:

a. Additions of refuse is spread evenly by repeated passage of landfill equipment.

b. Each layer is compacted thoroughly to a depth not greater than 2-3 feet.

c. The refuse fill is continued to the total depth of lift by repeating (a) and (b) above.

The depth of lifts in fill are ten feet or less in order to minimize settlement and surface cracking.

Daily Cover

Daily cover of the refuse is necessary to prevent fly and rodent attraction, blowing of litter, production of odors, fire hazards, and an unsightly appearance. Therefore the working face of the landfill operation will be covered at the end of each working day. As an alternative to the common means of daily soil cover, other materials are often available to accomplish the purpose of the daily cover. These alternate methods may be desirable because they decrease the amount of cover material necessary to be imported to the landfill site and conserve significant amounts of available landfill airspace.

Via this permit renewal application, Bountiful City is requesting approval to use the following as acceptable daily cover:

> **Soil** At least six inches (measured perpendicularly to the surface of the compacted refuse) of well compacted soil cover material shall be placed daily to completely cover all refuse deposited that day.
>
> **Wood Chips.** An alternate material available for use as daily cover is wood chips produced in the landfill chipping operation. If this material is used, at least six inches (measured perpendicular to the surface of the compacted refuse) of well compacted chips shall be placed daily to cover completely all refuse deposited that day. The wood chips should only be used for cover if no other beneficial use of the chips is available or if the amount of chips produced is in excess of the amount that can be used beneficially. In other words, if excess chips are to be disposed of in the landfill, they are acceptable for use as daily cover rather than simply disposing of them in the landfill cell.

Intermediate Cover

Intermediate Cover will consist of a one foot layer of properly compacted and maintained cover material to prevent health hazards or nuisances until the next lift is placed. Intermediate cover will be applied as follows:

a. At least one foot (measured perpendicularly to the surface of the compacted refuse) of well compacted cover material shall be placed daily on all surfaces of each lift on which another lift will be constructed, except where six inches of daily cover are provided as specified above.

b. The entire surface of the intermediate cover will be observed regularly and all cracked, eroded, and uneven areas will be repaired.

Final Cover

Final Cover will prevent the emergence of insects from the compacted refuse, minimize escape of odors and gases, prevent infiltration of water and leachate production and prevent rodent burrowing. This cover also provides adequate bearing surface for vehicles and sufficient thickness for cover integrity in the event of settling or erosion. Erosion of the final cover layer can be prevented by placing topsoil and vegetation over the compacted final cover. Previously, a prescriptive cover was proposed with 18” of low permeability clay and 15” of topsoil. We are now planning to use a Geosynthetic Clay Liner (GCL) final cover with a minimum of 24” of soil over the GCL. The final cover will meet the specification in R315-303-3(4).

The topsoil placed over the GCL will be capable of sustaining the growth of vegetation. The topsoil will be seeded with grass or other shallow rooted vegetation which will not penetrate the topsoil layer. The topsoil and vegetation will be placed as soon as possible after placement of the GCL (always within six months), but should be done during an appropriate season of the year that will allow the seeds to germinate and grow on the slope.

Until closure and post closure activities are complete at the landfill, the entire surface of the final cover shall be inspected monthly and all cracked, eroded, and uneven areas shall be repaired.

Blown Lightweight Materials

Blown paper and other light materials create litter and other nuisances. Therefore, blowing paper and litter is controlled in the following manner:

a. Temporary and portables fence are placed near the unloading and spreading area to catch windblown paper and other light materials.

b. The portable fence and surrounding area are policed regularly and all scattered material collected and placed in the fill.

c. The perimeter fence surrounding the landfill is primarily for the purpose of access control, but also serves as an interceptor to blowing paper and other litter. It is the final defense against the litter leaving the landfill site. The perimeter fence is policed regularly, and all scattered material is collected and placed in the fill.

After the solid waste is unloaded at the working face of the landfill, landfill operators will move the refuse to the location necessary in order to obtain the desired lift thickness and slope. The refuse will then be compacted to a minimum density of 29.6 pounds per cubic foot (800 pounds per cubic yard) by making several passes over the refuse with the compaction equipment. After the refuse is compacted to the desired density, lift thickness, and slope, an approved daily cover will be placed over the refuse in order to control vectors, fire, odor, blowing litter, and scavenging. The entire working face will be covered at the end of each working day.

Waste Handling Equipment

Equipment including compactors, dozer, loaders, dump trucks, water trucks, a backhoe, and a vacuum are used for refuse distribution, compaction, daily cover, cell excavation, and dust/fire control and litter control.

Equipment maintenance will be performed to include:

a. Routine maintenance and inspection of landfill equipment is performed on a schedule that meets or exceeds the recommendations of the equipment manufacturer.

b. Inoperative equipment will be repaired as soon as possible. Multiple pieces of equipment are kept at the landfill that can work in place of a compactor or a dozer that is under repair.

A complete equipment list with the anticipated replacement schedule is attached in appendix E.

Monitoring Schedule

Ground Water - History. Bountiful City has been sampling the groundwater at the landfill on a quarterly schedule since September 1996 when the new background and compliance wells were completed. Initially, the reason for sampling quarterly was to quickly produce sufficient data to develop background concentrations for the groundwater constituents. Upon obtaining sufficient background data to perform the appropriate statistical analyses, a statistically significant increase in arsenic concentrations in well BSL-3 was discovered. These results were reported to the Utah Division of Solid and Hazardous Waste in the annual Statistical Analysis Report for that year dated January 19, 1999.

As proposed in the report an assessment monitoring program was initiated which included taking one sample from well BSL-2 and one sample from well BSL-3 and having them analyzed for all constituents listed as Appendix II in 40 CFR Part 258, 1991 ed.. None of the Appendix II constituents were detected in any of the samples tested. Based on this, Bountiful received authorization to test only for constituents listed in Section R315-308-4 but were required to continue testing on a quarterly basis.

Current Program. The above testing schedule was followed until June of 2001 when authorization was given by the Division of Solid and Hazardous Waste to again amend the monitoring schedule, which was amended again in Feb. 2009 with authorization. Currently, organic and inorganic constituents are sampled and analyzed on a semiannual basis in all wells. Metals are sampled and analyzed semiannually in up gradient well BSL-1 and quarterly in wells BSL-2 and BSL-3. In July 2010, formal authorization was given to continue to analyze metals using filtered samples, which began in 2002.

In December 2011 the city submitted to the Division a request to establish alternate groundwater protection standards for arsenic in the landfill's compliance wells. These alternate groundwater protection standards were approved by the Division March 15, 2012. As part of Bountiful City's request to establish alternate groundwater protection standards for arsenic, Bountiful City proposed some additional sampling as recommended by the city's consultant (ERM, Rocky Mountain) to gather data for future evaluations regarding updates to the alternate groundwater protection standards. So, in 2012 the city began to monitor wells BG-1 and BG-2 semi-annually for field parameters, TDS, and arsenic. These two wells (placed in 2010) are down/side-gradient to the landfill and out of the landfill's influence.

This monitoring schedule allows accurately tracking the quality of the groundwater at the site and will not compromise the environmental integrity of our landfill operations.

Methane.

. Perimeter methane monitoring will be conducted on a quarterly basis. Calm-weather days will be chosen so that worst case conditions can be determined. Perimeter methane readings will be taken at random locations along the boundaries of the landfill. Methane readings will also be taken in each of the ground water monitoring wells immediately upon removal of the cap from the well. The methane concentrations in some of the wells are expected to be high, and will be for our information only. Sampling points for compliance will be at random locations around the perimeter of the landfill.

Methane monitoring in the buildings at the landfill will be conducted quarterly. Readings will be taken immediately upon arrival Monday morning after the buildings have been shut up with no activity over the weekend. This will likely produce a worst case situation, which will allow detection of methane problems in the buildings.

Self inspections of the monitoring systems, equipment, and operations will be conducted at least quarterly at the landfill to prevent malfunctions and deterioration, operator errors, or discharges which may cause or lead to the release of waste to the environment, or to a threat to human health.

Form

Database reporting forms and other forms for keeping an operating record are attached in Appendix D. This includes weights, types of waste received each day, number of vehicles entering each day, any deviations from approved plan of operation, random load inspections, self-inspections, and results of groundwater, stormwater, and gas monitoring. Training certificates are attached in Appendix F.

Assessment

Three new monitoring wells were placed at the site in spring of 1996. The new well locations were chosen in order to provide better compliance with section R315-308-2 (1-2), and to address concerns with well location and screen depth. One up-gradient well was placed at a location on landfill property, in an area unaffected by landfill operations. This is used to determine upgradient quality of the ground water. The property upon which this well is located has since been acquired by UDOT, but the well (which was retrofit into a manhole) is still being used. Two down-gradient wells were placed at a location far enough from the landfill area to be sure that it does not penetrate areas filled with refuse; these are the compliance wells.

Bountiful City maintains a software license agreement with NIC Solutions for *Sanitas* for Groundwater, and has an engineer who is trained in the use of the *Sanitas* software. *Sanitas* is a statistical analysis program specifically designed for analysis of groundwater data for regulatory compliance and MSW landfills. It provides various options for ground water analysis based on site specific conditions and statistical distribution of data. The license agreement with NIC solutions ensures that the latest version of the software is being used and any necessary software support is received. Bountiful city plans to continue the use of *Sanitas* for Groundwater as a means of statistical analysis compliance.

The Engineering Staff at Bountiful City are monitoring the quality of the groundwater at the Landfill site on a regular basis. The results of the groundwater monitoring and statistical analysis of the data are used to verify that the landfill is in compliance with the regulations for groundwater (R315-308). The results are also reported annually to the Division of Waste Management and Radiation Control with the Landfill Annual Report. Additional reporting is given if any of the groundwater constituents are found to be at a 95% confidence level above the compliance limit.
As new results of the groundwater monitoring program and the statistical analysis of the data become available, decisions regarding the quality of the groundwater within and surrounding the landfill will be adapted. Any new site the information will be submitted to the Executive Secretary along with our plans for implementing or expanding Assessment Monitoring activities if necessary.

The steps set forth in R315-308-2 will be followed in evaluating the groundwater monitoring data and determining if the implementation of additional monitoring is to be done, and whether a corrective action program at the site is necessary.

Contingency Plans

The design of the Bountiful Sanitary Landfill has been performed using sound engineering practice with factors of safety, and other design standards in an effort to minimize the potential hazards due to fire, explosion, release of explosive gases, or failure of the run-off containment system. Emergency evacuation of the site will probably not be necessary given the nature of the waste materials stored and processed. The probability of fire, explosion, or toxic vapor generation is remote.

Fire or explosion. Because burning of any kind is not allowed at the landfill, any fire intentionally ignited is considered vandalism, and will be pursued and prosecuted as such by landfill operators. Foreseeable means by which accidental fires or explosions may occur at the site include spontaneous combustion in refuse containers, or more likely, by hot ashes or sparks delivered to the landfill within the refuse stream. Landfill operators are trained in recognizing loads which contain hot ashes and will be instructed to prevent their disposal among other flammable refuse.

If a fire or explosion occurs at the site, the on-site Landfill Manager will be responsible to determine if there is any immediate danger to personnel. If it is determined that any immediate danger exists, the site will be evacuated immediately. If an evacuation is initiated at any time, all personnel will immediately demand all patrons to leave the site and will then leave the site themselves and meet for a head count outside the entrance gate. When danger to on-site personnel exists, the South Davis Metropolitan Fire District will be summoned to fight the fire.

If it is determined that no immediate danger exists, the on-site Manager will determine and implement a procedure to fight the fire. These procedures may include isolating the burning area from the working face and covering with on-site soil, use of the on-site water truck, use of the on-site fire hydrant, and fire extinguishers for small fires, and/or obtain support from the South Davis Metropolitan Fire District. All fires not immediately controlled by Landfill personnel will be reported to the Utah Division of Solid and Hazardous Waste.

Explosive Gas Release. Monitoring for explosive gasses will occur on a quarterly basis at the landfill boundaries, and in the buildings at the landfill. If it is determined that there are unsafe levels of explosive gasses during any of the monitoring activities, emergency evacuation of the landfill site will occur and immediate actions will be taken to reduce the levels of explosive gas. In the buildings, gas levels will be reduced by increasing the ventilation in the buildings. This will be accomplished by opening doors and windows, and if necessary by placing fans so that fresh air is forced into the building. The South Davis Metropolitan Fire District will be alerted to the high explosive gas levels, and their support in ventilating the building will be called upon if necessary.

If high explosive gas levels are discovered at the landfill boundaries, operators will immediately notify occupants of nearby structures, and where possible, test the air in nearby structures for explosive gas to determine if any immediate danger exists. If so, ventilation procedures of the buildings will be performed using procedures similar to those above.

Alternative Waste Handling or Disposal. The two foreseeable reasons that may require implementation of alternative waste handling at the landfill site are equipment breakdown and inclement weather. Landfill operators plan to keep equipment in top working condition by following manufacturer's recommendations for regular maintenance, and inspection of parts for the purpose of replacing parts receiving wear and tear through use. Bountiful City employs full time mechanics who can help expedite repair in break down situations. There is also some redundancy in equipment that will be used to continue operations while equipment is being repaired.

In the case of inclement weather or other emergency which would interrupt normal disposal of refuse, it is the opinion of the landfill operators, that due to the large size of the landfill, and available fill area, if an area cannot be used for disposal, landfilling activities can be moved to another more accessible or useable area within the landfill.

If emergency conditions exist that do not allow use of any part of the landfill on a temporary basis, waste will be diverted to another disposal facility such as the Salt Lake Valley Landfill, which has indicated that they will take waste from any entity including Bountiful City. Alternately, large bulk containers will be placed near the landfill, and a transfer station type operation will be temporarily employed. When conditions return to normal, the refuse will be placed in the landfill and compacted and covered as normal.

Maintenance of Monitoring Equipment

Maintenance of installed monitoring equipment will occur on an as needed basis. Ground water monitoring wells will be visually inspected during all sampling events and all regularly scheduled inspections. Any noted damage or wear to the monitoring systems will be assessed and repaired.

Methane gas monitoring equipment will receive regular re-calibration and maintenance according to manufacturer's recommendations.

The suitability of the monitoring systems to accomplish their desired purpose will be continually monitored. Upgrades and improvements will be made as warranted.

Dust Control

Excessive dust violates air quality regulations, slows operations, creates accident hazards and aesthetic problems, and may cause eye and respiratory irritation or other injury to landfill personnel or users. Therefore, suitable measures shall be taken to control dust wherever necessary on the site or on the access roads. These measures may include moisture conditioning the dusty areas with a water truck, portable water tank, or fire hydrant and hose.

The Fugitive Dust Control Plan is attached in Appendix M.

Disease Vector Control

The primary means of controlling disease vectors at the landfill will be to provide a daily cover over the working face of the disposal area at the end of each day. The cover will be provided in an attempt to prevent the propagation and harborage of rodents and insects, and to prevent odors which attract rodents and insects to the site. If it becomes apparent that vectors are present on the landfill site in uncontrolled numbers, supplemental vector control in the form of professional extermination or pesticides placed under the direction of a professional exterminator will be performed.

Dead Animals and Infectious Waste. Because refuse deposited in the landfill is limited only to that produced within the City of Bountiful limits, the need to dispose of dead animals is uncommon. If it becomes necessary to dispose of a dead animal, it will be deposited onto the working face at or near the bottom of the cell with other solid waste. It will be covered with at least 12 inches of earth or other solid waste. Any infectious waste will be handled similarly.

Tires. Waste tires, which tend to provide habitat for mosquito breeding, and harborage of other vectors such as rats, will be accepted only in small quantities (up to four at a time) and handled as special waste by placing at the bottom of a cell.

Prohibited Waste

The Bountiful Sanitary Landfill will not knowingly dispose, treat, store, or otherwise handle hazardous waste or waste containing PCBs. This includes, but is not limited to; toxic, liquid waste, chemical wastes, and asbestos-containing wastes. White goods containing chlorofluorocarbons will not be landfilled; they will be recycled after the refrigerant is removed, which is done on site by a third party.

Both the person at the gate and the person at the working face of the landfill will be trained in recognizing suspicious loads, including Pro wastes, drums, sealed containers, red bag wastes, and unusual markings or odors. All such waste will be refused.

As a means of keeping small quantity household hazardous wastes from being disposed of at the Bountiful Sanitary Landfill to the greatest degree possible, Bountiful City regularly conducts a household hazardous waste collection program. Under this program, the city accepts household hazardous waste from Bountiful residents and properly disposes of them. This both allows residents to be rid of hazardous materials, and also keeps them out of the landfill. A copy of the most recent flyer advertising this program is attached in Appendix G.

Load Inspection. All suspicious loads will be inspected by landfill personnel. Also, random inspections of loads will be performed by landfill operators. Random inspections will be performed at a frequency of approximately one load for every one hundred loads entering the landfill. The random inspections will be performed in addition to inspections of suspicious loads. Load inspections will be performed at an area near the landfill working face, but away from public access.

If hazardous or prohibited materials are discovered during the inspection process, the load will be denied access to the landfill, and notifications will be made as described in the section below for

“Notification Procedures.” Access to the area will be restricted, and the hauler will be asked to park the load until a decision can be made as to the appropriate disposal options.

If no hazardous materials are discovered in the load, the waste will be allowed to progress to the working face. The Landfill Manager will have ultimate authority to decide whether to accept or reject waste material. If a question exists as to the acceptability of refuse, the load will most likely be rejected and not allowed to unload at the site. The form attached in Appendix D will be used to keep record of each load inspection.

Notification Procedures. If hazardous waste or waste containing PCBs is discovered at the Bountiful Sanitary Landfill, the landfill operators will:

1. determine if any immediate threat to human health or the environment is present or imminent, if so, contact the 911 for emergency response from the South Davis Fire District;

2. request that the hauler park the truck (to be parked until the County Health Department can make a decision as to proper handling of the waste);

3. notify the Davis County Health Department immediately;

4. notify the Utah Department of Environmental Quality Executive Secretary within 24 hours;

5. secure the area, and restrict the area from public access and from facility personnel;

Supervision of Operations. The landfill operation will be directed by an individual deemed qualified as a *Certified Manager of Landfill Operations* by the Solid Waste Association of North America, or similar certification by a similar organization.

Accident Prevention and Safety. The use of heavy earth-moving equipment, the maneuvering of collection trucks and other vehicles, and the special materials that may be present in the refuse create situations of increased risk to those on and around the site. The relatively remote location of the landfill makes it particularly important that personnel be oriented to accident hazard, trained in first aid, and provided with first aid supplies. Therefore, the following will be employed at the landfill to promote accident prevention and safety:

a. At least one person with formal first aid training shall be on site during operating hours.

b. An educational program shall be maintained on safety and first aid.

c. Adequate first aid supplies shall be available at the site at all times.

d. Access to the site shall be limited as specified above.

General Training Plan

Training of landfill supervisors, managers, and on-site workers will consist of a combination of classroom training and on-the-job training. The Landfill Superintendent and on-site Landfill Manager are certified by the Solid Waste Association of North America (SWANA) as a Certified Managers of Landfill Operation. Full time on site Landfill Operators have completed the SWANA Landfill Operator Training Course which covered sanitary landfill operator training and waste screening at municipal solid waste facilities. This or similar training will be provided for all landfill personnel responsible for inspecting and identifying hazardous waste. Copies of all certificates of completion and training are attached in Appendix F.

Training of new employees and continuing training of current employees will be under the direction of the Landfill Manager. Initial training of new employees will be completed during the first three months of employment, and will include yearly reviews of basic waste management skills. The specific schedule for training will be as follows:

A. Introductory training: Overview Plan of Operations, Solid Waste Regulations, and Record Keeping.

Required: All personnel
Method: On-the-Job Training / Seminars
Review: Annual

B. Policies and Procedures: Security, inspections, monitoring, and emergency response.

Required: All Personnel
Method: On-the-Job Training, lecture, video media
Review: Annual

C. Safety: Personal protection, hazardous waste recognition and exclusion, hazardous materials handling, emergency response, and first aid.

Required: All Personnel
Method: Lecture, video, seminars
Review: Annual

Recycling Program

The City of Bountiful currently has an active recycling program for Bountiful residents. Items that are accepted at curbside: paper, cardboard/paperboard, metals, and plastics (PETE and HDPE). A copy of the Recycling Information is attached in Appendix G.

Large recycling bays are available at the landfill near the scale building. These are used to separate recyclables from the waste stream including aluminum, steel, batteries, e-waste, and white goods (appliances). Also, a recycling bin for used carpet padding is in use at the landfill.

Bountiful City also operates an aggressive green waste composting operation. Residents and haulers are encouraged to separate the green waste that they deliver to the Landfill for disposal.

Green waste is processed into compost and sold back to the public in order to divert a portion of the flow of refuse into the landfill, and to provide a great product to consumers.

FINANCIAL ASSURANCE PLAN

From 1962 to 1987 the Bountiful Sanitary Landfill operated under an Interlocal Cooperation Act Agreement as the Bay Area Refuse Disposal (BARD) by Davis County and six cities in the area. A "reserve fund" generated by tipping fees at the landfill was developed in order to cover closure costs. There was for a time, litigation regarding the future use of this fund. Because this fund was generated while all cities were members of BARD, the entities who no longer used the landfill felt that part of the money in the fund belonged to them, and therefore should be removed from the fund and returned to them. Bountiful City contended that since all entities had used the landfill, all should be partially responsible for closure, post closure, and any necessary corrective action at the site. On December 20, 1989 a *"Settlement Agreement"* was completed and submitted to the six cities and Davis County which was signed by all. This agreement was accepted and became effective on January 10, 1990. A copy of the *"Settlement Agreement"* is attached in Appendix H.

The agreement includes a section dealing with the fund developed, and states:

> *"Payment of BARD Fund."* Defendants hereby transfer, convey, and assign to Bountiful all of their rights, title, and interest to and in all monies currently deposited in Public Treasurer's Investment Fund, . . . , including accrued interest (herein referred to as the "BARD Fund"), the cash amount of which is approximately $1,862,642.12. The BARD Fund is held and managed by the State Treasurer pursuant to the State Money Management Act of 1974, Utah Code Ann. Section 51-7-1 (1953 as amended).

The agreement also includes provisions for Davis County to help in providing clay cover material, and does not release the other cities from a share of financial responsibilities which may come from any necessary corrective action, or other necessary improvements due to past landfill operation.

According to a January 22, 1992 amendment to the Settlement agreement, a portion of the fund has been used to perform design and operational upgrades. These include improving cover and grading over existing landfill areas to prevent infiltration and promote runoff, and realignment and lining of Barton Creek in an attempt to keep additional moisture from infiltrating into the refuse. The remainder of the fund is reserved for closure, post-closure, and corrective action financial assurance.

In addition to the above-described fund, Bountiful City has established a Landfill Closure Fund. Prior to November 1996, contributions were appropriated annually, and the amount varied each year. In November 1996, Bountiful City Entered into an “Escrow Agreement” with The Executive Secretary, Utah Solid and Hazardous Waste Control Board Department of Environmental Quality. At that time the Closure Fund was fully funded in the amount of $1,200,000.00. In December 2005, another “Escrow Agreement” was entered into with the Division of Solid and Hazardous Waste to update the 1996 Escrow Agreement. A copy of the current Escrow Agreement and a copy of recent Statements of Account from the Utah Public Treasurers’ Investment Fund are included in Appendix H.

The largest area that may require closure at any one time is the first lift on the north half of the landfill. If closure were to become necessary at this point in landfill operations, approximately 50 acres would require final cover.

Current closure and post closure costs are estimated for activities included in the current Closure and Post Closure Plans for the Landfill. Calculations are based on the unit costs and multipliers contained in the Utah Division of Solid and Hazardous Waste Guidance Document entitled “Preparation of Solid Waste Facility Closure and Post Closure Cost Estimates”. Estimated closure and post closure costs, with dollar value as of end of 2021, is detailed in a cost calculation included in Appendix H. This is updated from earlier estimates by incorporating estimated increased costs for GCL cover, rather than the prescriptive cover.

Bountiful City currently has a balance in a Closure Funds to meet the regulatory financial assurance requirements at 78.3% of expected costs.

The city intends to make a fund transfer in the spring of 2023 to add additional funds to a closure/post-closure account to bring the percentage above 100% .

CLOSURE PLAN

This closure plan has been designed to minimize the need for future maintenance, minimize threat to human health and the environment from post closure escape of solid waste constituents, leachate, landfill gasses, contaminated runoff or waste decomposition products to the ground, ground water, or surface water, and prepare the facility for the post closure period. Estimated costs for closure needs have been tabulated and are included in appendix H.

Final Cover Installation

Final Cover will be placed on finished areas at the end of each phase of landfilling (for phases II, III, and IV). Previously, a prescriptive cover was proposed with at least 18 inches of low permeability cover material covered with 15" topsoil. We are now planning to use a GCL covered with at least two feet of soil. Our intent is to ensure that the layer to minimize infiltration achieves an equivalent reduction in infiltration as the layer specified in Subsection R315-303-3(4). A Final Cover Plan including and QA/QC procedures will be submitted to the Division of Solid and Hazardous Waste; work on the final cover will not commence until the Division gives approval of the plan.

Two feet of soil will be placed over the GCL for sustaining vegetation growth and to provide protection from erosion. The soil will be seeded with grass, or other shallow rooted vegetation which will not completely penetrate the topsoil layer. The soil and vegetation will be placed as soon as possible after placement of the GCL during an appropriate season of the year that will allow the seeds to germinate and grow on the slope (always within six months).

Frost depth analysis shows frost depth at 15 inches. However, minimum confining stress over the GCL requires 24 inches of soil. Even if frost depth were more than 24 inches, there are no structures or improvements planned on top of the landfill so there would be no need to provide additional cover for protection of the GCL (See Landfill Cover Stability Study, IGES, Oct. 14, 2021). Bountiful's site specific frost penetration analysis can be found in Appendix I of this application.

Site Capacity

The fill plan at the landfill site and compaction specifications have been designed to maximize the useable area of the landfill site, and to provide as much life as possible, while still providing for a stable, and sound engineered landfill. The site capacity has been determined based on side slopes of 33%, and a top slope of 5% per the recommendations from a geotechnical professional. The planned top slope is more than the 2% minimum final cover slope allowed by rule 315-303-3(4)(a).

Assumptions. Site capacity of the landfill has been calculated using the following assumptions:

1. Refuse handled currently averages approximately 100,000 tons per year (about 330 tons per day. It is assumed that waste reduction and recycling programs, including composting operations, will offset increased population, to produce no increase in quantity of refuse handled at the landfill above current levels.

2. The compacted refuse density is 1550 lb/yd^3, after the waste has been in place for some time and initial settlement has occurred. This is based on volumes derived from several comprehensive surveys along with scale records of waste acceptance. This density accounts for daily cover and intermediate cover; soil is normally used for both.

3. The airspace will be filled according to the fill perimeter, slopes, and top elevations as shown on the fill plans. The volumes available for refuse have been adjusted to account for final cover.

Calculations. Calculations of remaining available space were made as of April 2021, with updated assumptions for revised fill plans having 3:1 final slopes, with a waste density of 1550 lb/yd^3. At this time, approximately 7.639 10^6 yd^3 of landfill space was available for refuse, 2.892

x 10^6 yd^3 of which was available in the current phase (Phase II). Based on the above assumptions this phase (Phase 2) can provide operation until about 2043.

Phase III has approximately 3.165 x 10^6 yd^3 of landfill space available for refuse Based on the above assumptions, this area will provide about 25 years of operation.

Phase IV has approximately 1.582 x 10^6 yd^3 of landfill space available Based on the above assumptions, this area will provide about 12 years of operation.

Based on the conclusions from the Remaining Life Study with current waste disposal rates and practices, it has been calculated that the landfill's life will end in approximately year 2080. However, small changes in variables involved in calculating landfill life can make it nearly impossible to anticipate capacity over that long of a time frame. However, our current estimate of the end of landfill life for planning and reporting is year 2080. More details can be found in a 2021 Remaining Life Study that was performed for the landfill, included in Appendix C.

Final Inspection

As closure of each phase of the landfill has been completed, landfill operators will submit, to the Solid and Hazardous Waste Division of the Utah Department of Environmental Quality, copies of the as built, approved unit closure plan sheets signed by a professional engineer registered in the state of Utah. Certification will be provided by the landfill operator and a registered professional engineer that the unit has been closed in accordance with the approved closure plan. Operators will then request a final inspection of the closed portion by applicable regulators. Upon approval of the closure of each section, post closure monitoring and maintenance will begin.

POST CLOSURE PLAN

This post closure plan has been designed to provide continued facility maintenance and monitoring of gasses, land, and ground water for 30 years, or as long as regulators require for the facility to become stabilized and to protect human health and the environment.

Monitoring

Semi-annual ground water monitoring and quarterly gas monitoring will continue as stated under the landfill specifications and plan of operations until evidence exists that little or no gas is being produced or becoming concentrated in dangerous amounts, and it is consensually determined by landfill operators and the Department of Environmental Quality that further monitoring is not necessary.

Maintenance

Quarterly inspections of the monitoring systems, the facility, the facility structures, final cover, and run-on/run-off systems will be conducted at the landfill throughout the post closure care period. Any deterioration of any of the facilities, or systems will be noted on the inspection report and repaired promptly.

Implementation

As discussed above, post closure care activities will begin upon completion of closure activities at each section of the landfill.

Individual phases of the landfill may be in differing stages of post closure care at the same time. When closure on the final stage of the landfill is completed, it is anticipated that part of the landfill (phases I, and II) may be nearing completion of the required post closure activities. Continued post closure activities on phases III, and IV will provide for limited extended post closure activities on the entire landfill in order to maintain necessary facilities.

Record of Title, Land Use, and Zoning

No specific plans have been outlined as to the future use of the landfill property. However, it is anticipated that Bountiful City will retain ownership of the property. Keeping in mind that the future refuse disposal needs of Bountiful City must be addressed, plans at the landfill site may include operation of a transfer station, which could be expanded to provide for disposal needs even after the landfill is closed. Some possible recreational uses have also been speculated.

Regardless of the future use of the landfill site, changes to the record of title indicating that the property had been used as a sanitary landfill will be performed, and appropriate zoning restrictions will be proposed.

Post Closure Costs

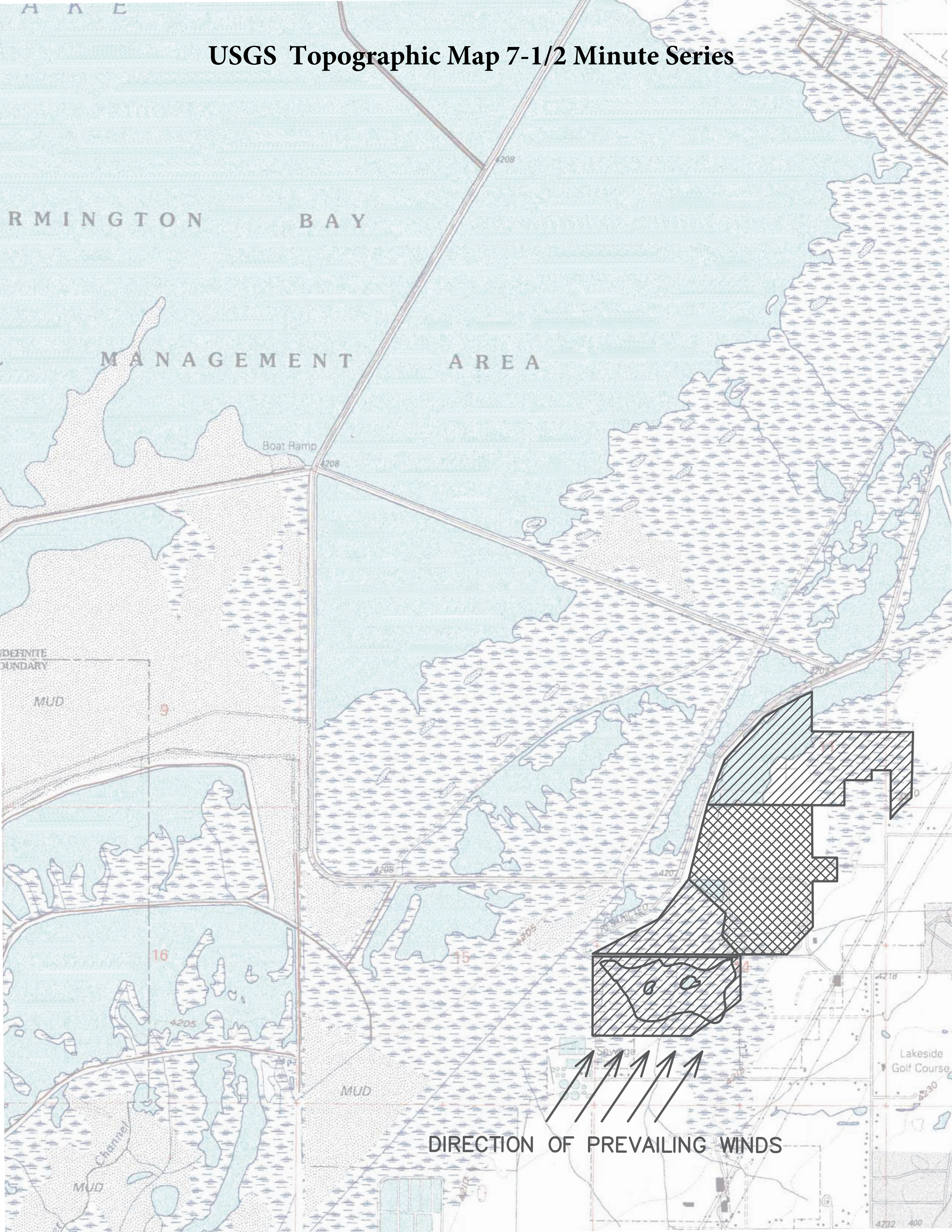
The cost for post closure care that is performed during operation of later phases of the landfill is planned to be incorporated into regular landfill operating costs, and therefore will be minimal. No withdrawal of funds is anticipated during this time.

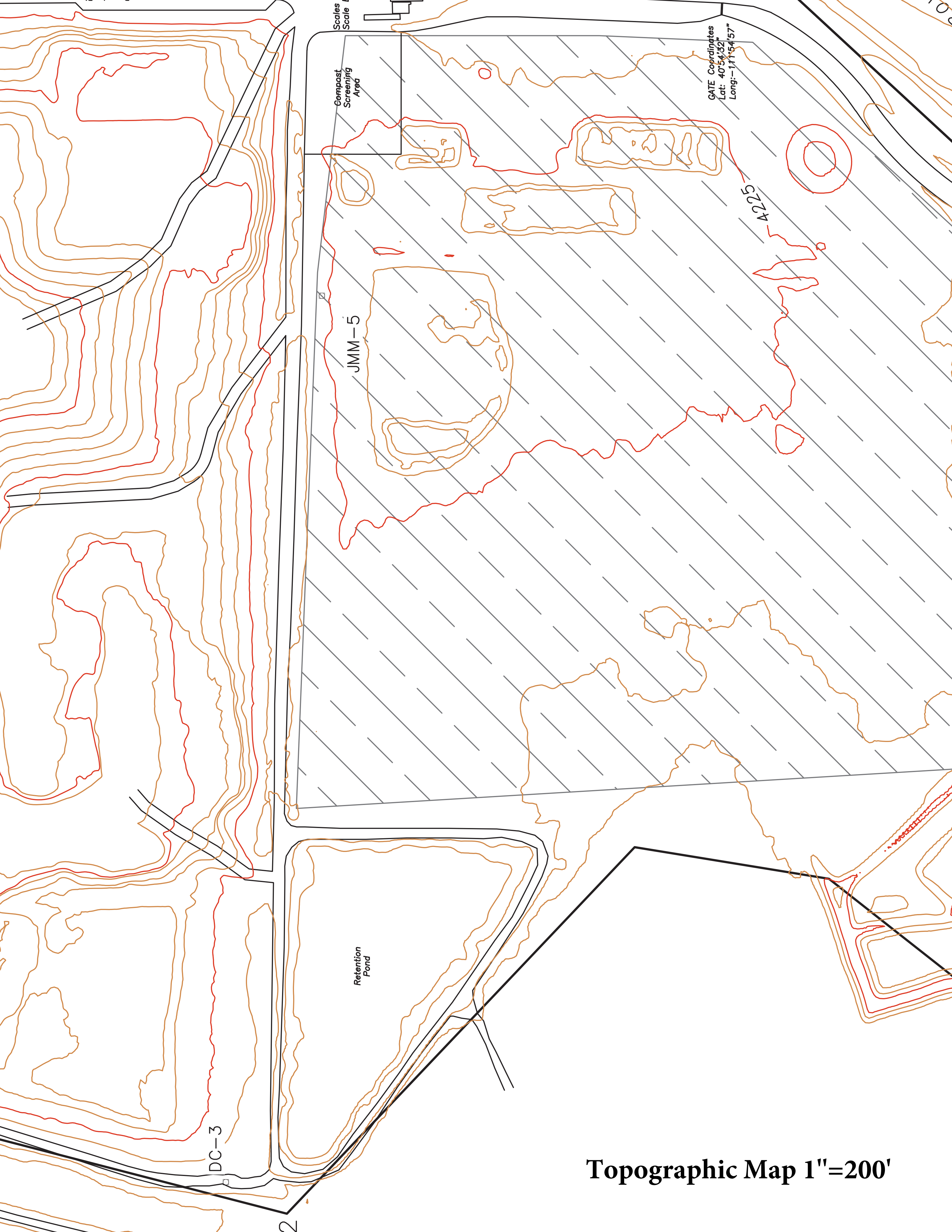
Post closure care that is performed after regular operations at the landfill have ceased will be under the supervision of the Public Works Director and will be performed by trained Bountiful City Employees. Maintenance will be performed when necessary with equipment owned by Bountiful City. Estimated costs for these operations are included in appendix H.

Attachment 2

Technical Data

USGS Topographic Map 7-1/2 Minute Series





Topographic Map 1"=200'

BOUNTIFUL SANITARY LANDFILL SPECIFICATIONS

Specifications for the Bountiful Sanitary Landfill have been prepared in an attempt to ensure continued operation of the landfill in a safe, efficient, and sanitary manner. Based on observations made of current operational procedures, and on apparent operations in the recent past, few, if any, operational changes will be necessary beyond those already implemented in order to be in compliance with these specifications.

Preparation of Site

1. **Access.** In order to avoid needless expense, it is important that collection vehicles are not delayed at the collection site and that all refuse is unloaded only at the working face. Because the refuse hauling time is unproductive for the refuse collectors, any unnecessary delays are costly, and can result in unfinished collection routes.

   Therefore, access roads to the site and within the site will be designed and constructed so that traffic will flow smoothly and will not be interrupted by ordinary inclement weather. All-weather access roads will be provided from the entrance gate to the working face of the landfill. Maintenance will be provided on the access roads as needed to keep the roads in good condition.

   Fencing limits access so that indiscriminate unloading of refuse and accident hazards are minimized. Therefore, access to the site will continue to be limited by suitable fencing, and the following procedures are employed to limit access to the landfill:

   a. The gate shall be open only when an attendant and equipment operator is on duty. The gate shall be locked at all other times.

b. Hours of operation and other limitations to access shall be displayed prominently on a sign at the entrance gate.

c. An attendant shall be on duty at the scales near the landfill entrance during operating hours and will be responsible for preventing unauthorized persons from entering the area.

2. **Equipment Shelter.** Protection of equipment from the weather reduces deterioration and maintenance. Shelter is also necessary for equipment servicing; for routine maintenance; and for storage of tools, service equipment, spare parts, and other supplies. Therefore, a permanent shelter of suitable size is provided to accommodate landfill equipment and other necessary supplies.

3. **Employee Facilities.** Shelter is necessary for protection of the landfill employees from inclement weather. Toilet and washing facilities, are necessary for good personal hygiene of the landfill employees and patrons. Therefore, shelter and restrooms are provided with safe drinking water, sanitary washing and toilet facilities, electricity, heating facilities, and proper ventilation.

4. **Weighing Facilities.** A method of measuring incoming refuse is necessary to provide reliable quantity data, to determine trends, and to estimate future disposal needs. Experience has shown that refuse quantities should be based on weight rather than volume if the data are to be reasonably accurate for comparative purposes. Weighing provides an equitable basis for establishing fees for refuse disposal. Weighing also provides the basis for cost analysis of landfill operations. In addition, weighing provides a means for the constant surveillance of collection crews and encourages the delivery of adequate payloads by each truck.

   Therefore, suitable scales are provided and operational during the hours that the landfill is open. All commercial loads are weighed prior to unloading to determine net weights delivered. Weights of small loads are estimated based on the nature of the truck and/or trailer hauling the load. The scales are calibrated regularly, and are registered with the State Department of Agriculture and Food.

5. **Communications.** Communications are necessary at the landfill site, especially in cases of emergency. Personnel at the working face of the landfill, the scale house, and the operations center should be able to conveniently communicate with each other. Telephone communication should be available at the site for the purpose of communicating with emergency services if needed.

   Therefore, two way radios are installed in landfill vehicles, scale house, and operations center. Telephone communication is established and maintained at the operations center of the landfill and at the scale house.

6. **Fire Protection.** Fires endanger life and property. Smoke and odors create nuisances to surrounding property owners, violate state and federal air quality standards, and interfere with landfill operations.

   Therefore, no fires are permitted at the landfill site. Any fire which occurs at the landfill is aggressively extinguished. This is accomplished by any combination of the following:

   a. An adequate supply of water under pressure. This includes, a portable water truck or tank, and/or a standard fire hydrant connected to a suitable water supply.

   and/or,

b. A stockpile of earth is maintained reasonably close to the working face of the fill.

and/or,

c. A nearby organized fire department shall provide immediate service whenever called.

Suitable fire extinguishers, maintained in working order, are kept in all landfill vehicles, on all landfill equipment, and in both landfill buildings.

GEOHYDROLOGICAL ASSESSMENT REPORT

This section of the permit application presents a summary of the regional geologic and hydrogeologic setting around the Bountiful Sanitary Landfill and the local soil and ground water conditions at the landfill. The information was generated from published material by the U.S. Geological Survey (USGS), the Utah Geological and Mineral Survey (UGMS), and other publications, combined with two reports prepared for the City of Bountiful by private consultants. One of the reports was prepared by EMCON Associates entitled "Geotechnical Investigation and Waste Management Studies; BARD Disposal Site". The other was prepared by James M. Montgomery, Consulting Engineers, entitled "Groundwater Quality Assessment Report for the BARD Landfill."

Geology

Regional Conditions. The Bountiful Sanitary Landfill lies on the eastern shore of the Great Salt Lake, which is situated in the Basin and Range physiographic province. The Basin and Range Province is characterized by parallel northwest-trending mountain ranges separated by alluvium filled valleys. The Great Salt Lake Basin consists of a broad, flat valley bordered by the Wasatch Mountains on the east, and the Oquirrh Mountains on the West. The Basin and Range physiographic province is further characterized by internal drainage to closed depressions in the valley bottoms. The Great Salt Lake is the largest of these depressions in northern Utah.

The eastern margin of the Basin and Range physiographic province is the Wasatch Fault located at the base of the Wasatch Mountains approximately 2 miles east of the landfill area. Areas east of the Wasatch Fault lie within the Middle Rocky Mountains physiographic province, which is characterized by generally high mountain ranges and plateaus transected by deeply incised erosional valleys.

The Wasatch Mountains in the area of Bountiful are composed mainly of metamorphic and granitic rocks. These materials are typically Precambrian in age (greater than 600 million years old) although some Tertiary age (approximately 50 million years old) gravels are located south of Bountiful. The Principal rock type is highly metamorphosed gneiss assigned to the Farmington Canyon Complex Formation. The Gravels south of Bountiful are found on the surface of the mountainsides and consist of angular pebbles, cobbles, boulders, sand and silt sized grains eroded from nearby parts of the Wasatch Range.

Sediments in the Salt Lake Valley were deposited by prehistoric Lake Bonneville as lacustrine sediments. These soils are typically interbedded silty clays and clayey silts with some sandy and gravelly layers. Some layers, especially the clay deposits, are laterally continuous. The coarser grained deposits tend to grade finer toward the west, and the thickness of these coarse grained layers generally decreases and tend to eventually pinch out. Thickness of the valley fill in the area north of the landfill is estimated to be greater than 2000 feet.

Local Conditions. Soil and ground water conditions at the site were investigated by reviewing the logs from existing ground water monitoring wells, test borings, and examining excavation cut slopes associated with on-going landfill operations. The excavation cut slopes provided detailed data on soils in the shallow zone beneath disposal areas. Test boring information, together with logs of existing monitoring wells, supplied information on the nature of the subsurface soil and ground water underlying the disposal site.

The natural slope of the site is very slight (generally less than 1%) toward the west. For this reason, natural unstable slopes do not exist. Slope failure in excavation cuts and mounds created during the landfilling process may present slope stability concerns if they are over-steepened or become saturated.

Ground subsidence at the site is not anticipated. However, differential settlement of the refuse fills, and underlying clay soils due to increased overburden pressure from the weight of the refuse and cover materials should be anticipated and included in landfill design parameters.

Excavation cut slopes and the logs from exploratory borings and ground water monitoring wells confirmed that subsurface soil conditions beneath the site are generally consistent with the regional conditions described earlier. The test boring logs revealed the site is underlain by silty and sandy clays with occasional thin (generally less than 1.5 feet thick) mostly discontinuous interbeds and lenses of sand and sandy silt. Field and laboratory analyses showed that clay soils are classified as CL (low plasticity clay), and the interbeds and lenses of silty sand are classified as SM (sand-silt mixture) by the Unified Soil Classification System. Laboratory permeability tests performed on undisturbed samples of the clay soil underlying the site produced permeabilities in the range of 1 x 10^{-8} cm\sec. In the JMM report, the consultants identified a distinct layer of red clay which they identified as a marker bed. This clay layer had a uniform consistency, and it predictably occurred beneath a silty sand layer in each of the borings.

The slope of the soil layers can be measured with the red clay marker bed. The cross sections attached in Appendix J show a planar surface that dips towards the northwest at approximately 0.6 percent, or 30 feet per mile. The presence of an aerially extensive layer demonstrates that the entire landfill is underlain by a continuous clay layer, which should effectively isolate the refuse from deeper soil layers and water bearing units.

An interpretation of the soil beneath the Bountiful Sanitary Landfill is presented on the cross sections attached in Appendix J. These cross-sections were prepared by James M. Montgomery

Consulting Engineers, Inc. (JMM) in 1988. One cross section presents a southeast to northwest view, which is parallel to both the direction of the dip of the soil units, and the general direction of the ground water flow. The other cross section shows a view parallel to the north perimeter dike, which is down gradient from most of the landfill.

Several fine sand and silty fine sand layers ranging from 1 foot to less than 1 inch thick were identified in most of the borings. As shown in the cross sections, some of the sand layers may be continuous beneath the landfill. The Sand layer immediately on top of the red clay marker bed was selected as the water bearing layer by JMM and they completed several groundwater monitoring wells with screen in this layer.

Although the sand layers decrease in thickness and increase in silt content toward the northwest, they occur predictably in the sequence of soil types encountered in the soil borings from both reports described above. This would indicate that some of the soil layers may be continuous beneath the landfill, but it appears permeability decreases, and that the sand layers "pinch out" at some distance either beneath or west of the landfill.

Hydrogeology

Regional Conditions. The area between the east shore of the Great Salt Lake and the Wasatch Mountain Range from the mouth of the Jordan River to the south, to the mouth of the Bear River to the north is defined as the East Shore Ground Water Province. The province is further subdivided into three subareas or ground water districts. The Bountiful Sanitary Landfill lies in the Bountiful District, which includes the east shore areas south and east of the Farmington Bay Bird Refuge.

Sediments at the base of the Wasatch Range consist mainly of coarse grained delta, slope wash and alluvial deposits which grade westward to predominantly fine-grained lacustrine deposits. The aquifers consist primarily of sand, gravel, or mixtures of materials. A major portion of the water infiltration into the aquifers occur along the base of the mountains where course sediments occur near the ground surface.

In general, ground water in the East Shore Province is found mainly under artesian conditions in a multi-aquifer system and moves generally westward from the recharge areas along the Wasatch Front toward the Great Salt Lake. Some of the Ground water is intercepted and discharged by wells; some moves through overlying confining beds and is discharged onto the ground surface as springs; some discharges directly into the Great Salt Lake, and some continues through the aquifers westward under the Great Salt Lake.

In the Bountiful District, ground water is produced from three, deep artesian aquifers. The tops of the aquifers range from 60 feet to more than 500 feet below ground. Their thicknesses vary, and it is frequently not possible to distinguish among aquifers. Most wells in the western Bountiful District are small diameter, and may flow under artesian conditions. Water produced from these wells is used for stock watering, irrigation, and domestic purposes.

Local Conditions. The occurrence of ground water beneath the disposal site was evaluated by correlating information obtained from a reconnaissance of the site, existing groundwater monitoring wells, and results of semi-annual sampling and analytical testing of the shallow groundwater over the past several years. Shallow groundwater at the site was found perched within the beds and lenses of sand and sandy silt within the predominantly clay soils. The uppermost groundwater was generally encountered at depths ranging from 4 to 12 feet beneath ground surface. The location of the wells combined with corresponding groundwater elevation, suggests a gentle flow gradient in the shallow groundwater toward the northwest. The horizontal movement of the shallow groundwater is limited however, due to the predominance of extensive, low permeability clay deposits beneath the site. Laboratory tests have confirmed that these clays have natural permeabilities in the range of 10^{-8} cm/sec. Downward movement of the shallow groundwater probably does not occur at the site due to the above described upward artesian piezometric pressure from the deeper aquifers. The source of the water in the shallow sand lenses is probably a combination of upward seepage from the deeper artesian aquifers and infiltration of surface water.

Shallow Water Bearing Zones. As shown in the landfill cross-sections attached in Appendix J, some of the lithologic units may be continuous beneath the landfill. All of the JMM monitoring wells, with the exception of JMM-5, are screened in the uppermost silty sand layer which lies beneath the landfill. A review of the soil boring logs shows that the consistency of this layer ranges from a clean fine sand approximately 1 foot thick to interbedded silty fine sands and fine sandy silts approximately 3.5 feet thick. At several locations, approximately one inch thick silty clay layers are interbedded in the sandy zone.

In-situ permeability tests were performed by JMM in the eight wells that they placed at the landfill site. The hydraulic conductivities in the shallow zone ranges from a low of 6.0 x 10^{-4} centimeters per second (cm/sec) in JMM-4, to a high of 2.8 x 10^{-3} cm/sec in JMM-3. These values are typical for the silty sand deposits in which the monitoring wells are screened.

The 1-foot thick layer was the most transmissive, shallow water-bearing zone identified immediately beneath the landfill. Although it transmits ground water to some degree, it has none of the properties that are typically associated with an aquifer. It contains non-potable water with naturally degraded water quality, and it is not thick enough to readily yield water to wells. Therefore, the sand layer will be referred to as the uppermost "water bearing zone".

Groundwater also occurs in the refuse, and the water table in the refuse is monitored by wells JMM-5 and DC-4. Water accumulates in the landfill from precipitation, limited groundwater inflow, and moisture imported within the refuse. The water table in the refuse appears to extend to the perimeter of the landfill as indicated by the water levels measured in DC-4, which is located at the northern edge of the landfill. A groundwater elevation contour map is attached in Appendix J; this shows groundwater elevations based on data gathered from the wells in 2003.

Deeper Water Bearing Zones. In addition to the shallow zones discussed above, several other relatively transmissive sandy layers were identified at greater depths in the piezometer borings performed by JMM. These sandy zones range from one inch to several inches in thickness, and also change in consistency from clean sands to silty fine sands and fine sandy silts depending upon the location. These deeper layers differ from the shallow layers because the ground water is under artesian conditions in the deep layers. However, the deeper water-bearing zones are similar to the shallow layer because they also do not have the properties of an aquifer.

Shallow Ground Water Surface. Descriptions of the ground water surface are based on ground water levels measured in the monitoring wells on site. The ground water elevations for all wells and the piezometers are summarized in the table attached in Appendix J. In addition, a contour map for the shallow water bearing zone based on average water levels is attached in Appendix J. Water levels measured in the piezometers represent artesian conditions at depth and are discussed in the following section.

Examination of the groundwater elevations in the wells shows that a relatively flat area in the groundwater surface exists within the refuse in the center portion of the landfill. The groundwater surface elevation appears to be uniform within most of the landfill then drops off steeply to the static groundwater level of the upper most water bearing zone, generally near the level of the Great Salt Lake.

Shallow ground water levels within and adjacent to the landfill are strongly influenced by the Great Salt Lake level. Since 1985, shallow ground water levels in the wells have fluctuated in parallel with the Great Salt Lake. Ground water levels and the lake level rose about 3 feet during a period from 1985 to 1987, and since that time both the lake level and the Groundwater level have been generally declining.

Deeper Ground Water Surface. The piezometric surface of the ground water measured in the piezometers are generally 1 to 6 feet higher than that of the shallow ground water measured in the adjacent monitoring well. The piezometers tap water-bearing zones at 35 to 45 feet below ground, while the monitoring wells were completed in a 1-foot sand layer at 9 to 20 feet below the ground. The differences between ground water elevations measured in piezometers and monitoring wells demonstrate that an upward hydraulic gradient exists beneath the landfill. That is, ground water tends to flow vertically upward because the potentiometric head increases with depth.

It is likely that there is hydraulic communication between the Great Salt Lake and the sand layers at depth beneath the landfill. Ground water in these layers flows underneath the landfill and discharges into the lake, driven by the hydraulic gradient between the sand layers and the lake. It is unlikely that any deep ground water flows upward into the landfill because it preferentially flows horizontally through sand layers into the Great Salt Lake. The sand layers are much more permeable than the clay layers, so ground water flows more readily in the sand layers.

Seismicity

The zone of seismic activity traversing Utah is comprised of several major faults. The Major fault closest to the disposal site is the Wasatch Fault located approximately 2 miles to the east.

Seismic activity has been documented in Utah since 1850, and reveals that sporadic earthquakes have been concentrated in the northern and southern portions of the Wasatch Front. Six extensively damaging earthquakes, with intensities ranging from VII to IX, and at least ten which resulted in minor damage, have been recorded. However, ground displacement following an earthquake in Utah has been recorded on only one occasion. Based on this record, it is likely that the disposal site vicinity will experience the effects of seismic activity in the future.

According to the Open-File Report 82-1033 published by the United States Department of the Interior, Geological Survey entitled *"Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States"* by S. T. Algermissen and others, the horizontal acceleration in rock with 90 percent probability of not being exceeded in 50 years is 0.20g in the vicinity of the landfill. Additionally, the UGSG Unified Hazard Tool deaggregation for the site, the Weber segment of the Wasatch Fault (the largest contributor to seismic hazard) contributes a hazard for peak ground acceleration of 0.643g with a 2 percent probability of exceedance in 50 years (2,475 year return period). This was reported in a geotechnical report by IGES in 2021 with data from the website: https://earthquake.usgs.gov/hazards/interactive/ (see Appendix L).

Water Rights

A November 2022 search of the Utah Division of Water Rights (DWR) records show that there are many water rights that have a point of diversion within 2000 feet of the landfill facility boundary, most of which are for underground water rights. It appears that one of the rights, a surface water right (31-3840), has a point of diversion in the middle of the landfill. This is apparently a right that was issued by the DWR to Bountiful City for use of water from the creek and before the creek was moved to the south of the landfill.

Another right (31-4354) has a diversion point at the edge of the facility boundary and is for livestock watering – 7 horses. It is on the edge of a property that UDOT purchased as part of the Legacy Parkway project and is now used for the landfill shop and composting areas. It is apparent that the water is not currently being used, at least not at the original point of diversion. The landfill facility is on the land having the original point of diversion, which is now surrounded for at least 500 feet by the landfill and Legacy Nature Preserve/Legacy.

Bountiful City owns several underground water rights with an original point of diversion near the southeast portion of the facility boundary. In 1997, Bountiful City filed a Change Application to consolidate these and other water rights. The consolidated diversion points are at well locations that existed or were proposed at that time. The Change Application was approved, and all new diversion points are at least a mile from the landfill.

None of the other points of diversion found from the November 2022 search, that are within 2000 feet of the landfill, are down-gradient. And, all of the underground water rights (within 2000 feet) are to draw from deep ground water, typically between 100 and 500 feet deep. Maps, tabulations, and other documents related to the water rights/wells search around the landfill are included in appendix K.

Surface Water

The Bountiful Sanitary Landfill is located near the southeast shore of the Great Salt Lake. Other surface water within a one mile radius of the site consists of the following:

- Barton/Stone Creek which runs in a concrete lined channel immediately south of the site.
- A 2000 foot long by 800 foot wide man made fresh water pond located south of the landfill.
- Mill Creek which is located South and West of the above-described pond.

Barton/Stone Creek originates as runoff from the west face Wasatch Mountains and flows south of the landfill into the east end of the fresh water pond. The trapezoidal shaped concrete lined channel in which the Creek flows was constructed in 1991, and a part of it was re-located in 2006 as part of the Legacy Parkway project. It is designed to carry flows from these creeks which would be produced by a 100-year storm event. No flood plain would be produced in the vicinity of the landfill from a 100-year storm.

Mill Creek also originates as runoff from the Wasatch Mountains and flows from the south into the south edge of the pond. Any flood water that comes from Mill Creek will discharge into the pond and will be discharged into the wetlands of Farmington bay. No part of Mill Creek is adjacent to the landfill. Therefore, landfill operations will be unaffected by flooding in Mill Creek.

The pond was created in 1991 under a permit from the U.S. Army Corps of Engineers. It was built as part of a larger plan to move Barton/Stone Creek out of the landfill site, and to obtain cover material for landfill operation. The cover material was removed from the area south of the landfill, which produced a planned pond to serve as a sediment trap, and wetlands restoration. Infiltration of stream water from Barton/Stone Creek into the landfill has been halted due to the concrete lining of the channel, and it's realignment away from the refuse disposal area.

During the early to mid-1980's the high level of the Great Salt Lake had significant impacts on the landfill, and the surface and ground water in the area of the landfill site. During 1985-86, dikes were constructed around the perimeter of the landfill in order to prevent the lake from intruding into the landfill areas and to prevent washout of solid waste to the lake. Portions of the landfill area to the south and west (in the area of the new pond and wetlands) were completely inundated by the lake and portions of Barton/Stone Creek were overtopped by the lake. During the highest level of the lake, the entire landfill was surrounded by open water from the Great Salt Lake except for the entry road on the south east corner of the site, which remained open.

The dikes which were placed during 1985-86 proved effective in preventing surface encroachment of lake flood water from entering the landfill site. They were also effective in preventing the washout of refuse from the landfill site by the flood waters. Registered professional engineers from Postma Engineering Inc. performed an on-site inspection of the dikes in 1987 and in their June 1987 report prepared for the BARD Board of Directors stated “We have evaluated the dikes and found them to be sufficiently stable.” Past performance of the dikes during highly variable conditions verify Postma’s conclusions. These shallow dikes, however are relatively permeable. They are constructed of granular materials obtained from the excavation of debris basins constructed in the eastern foothills. Therefore these dikes, although effective in preventing washout of refuse, may do little to keep water from infiltrating into the landfill site if the lake water level rises to these levels again. However, the Great Salt Lake pumping project, which was initiated around peak lake levels, was designed to keep lake water levels below elevation 4212 NGVD 29 (4215 NAVD 88). Therefore the likelihood of lake water reaching elevations high enough to cause problems of infiltration to the landfill is greatly diminished.

Drainage of Surface Water. Runoff from above the fill and rain falling on the fill may, unless diverted, leach into the fill and pollute ground or surface water with the leachate. Cover soil may be removed by erosion. Standing water may permit mosquito breeding and interfere with the operation of the landfill. Therefore, the following means are employed to promote drainage of surface water from the landfill area:

a. Construction of the landfill will proceed in a manner which causes all runoff from the active face of the landfill to drain toward the borrow ditch areas along the main haul road in the center of the landfill, (see Runoff Control Plan in Appendix B). The borrow ditch adjacent to the haul road will move the runoff water to the storm water retention pond where it will be allowed to evaporate.

b. The surface of intermediate covered fill will be smooth and graded to a minimum slope of 1%.

c. The surface of the final covered fill will be smooth and graded to a minimum slope of 2%.

d. Maximum slope of the sides or toe of the completed fill shall not be greater than 33% and the slope shall be adequately protected from erosion by vegetation or rip-rap. The bottom of the slope will also be protected from raveling. The slopes will be constructed to provide surface drainage that prevents ponding.

e. Regular inspections shall be made for standing water on the site and on the access roads. All accumulations of water outside of the run-off collection/evaporation pond will be eliminated.

Ground Water Quality

Deep Ground Water. Ground water from several deep wells (250-600 feet deep) penetrating the underlying aquifers in the site vicinity has been periodically sampled and subjected to laboratory analysis by the State of Utah. These off-site analyses indicate that the ground water sampled is of a sodium bicarbonate type, has a total dissolved solids (TDS) content of approximately 250 milligrams per liter, and is generally of good quality.

Shallow Ground Water. Operators of the Bountiful Sanitary Landfill have had a shallow ground water monitoring system in place and operating for many years. Based on the information obtained from this program, it has been determined that unlike the deeper ground water, the background quality of the uppermost ground water is poor, and is of no beneficial use. Due to the age of the landfill, (refuse has been being deposited in this area since approximately 1960) it is not possible to determine the background quality of the ground water prior to any landfilling activities. It is expected however, that the shallow ground water in the area has always been of poor quality and lacked beneficial use due to the natural environmental conditions. Many of the "Constituents for Detection Monitoring" in section R-315-308-4 of the "Solid Waste Permitting and Management Rules" are detected both upgradient and down gradient from the landfill.

As would be expected, the ground water quality becomes substantially degraded as it moves closer to the Great Salt Lake. This is due to lake water intrusion into the water bearing strata. Lake water intrusion would cause an increase in total dissolved solids and many of the major ions. This theory is validated by the data obtained during the ground water monitoring program.

Ground water monitoring reports have been submitted over the years to the Utah Department of Environmental Quality (DEQ) offices. These reports contain the results of the monitoring that has been done from the landfill’s monitoring wells. A statistical analysis of the groundwater monitoring data at the landfill has been submitted annually to the DEQ since January 1999. Landfill operators will continue to work closely with regulators in order to ensure that all necessary information is obtained and all groundwater quality concerns are addressed at the landfill.

Site Water Balance

A water balance for the landfill was calculated by James M. Montgomery Consulting Engineers, Inc (JMM) in their report entitled "Groundwater Quality Assessment Report for the BARD Landfill". The calculated water balance is attached in Appendix J.

Conceptual Design of Ground Water Monitoring System

The groundwater monitoring system at the landfill site was developed and installed in at least three phases. Well numbers DC-1 through DC-4 were installed in 1985 by the Davis County Health Department. The intent of these wells was to provide one upgradient and three down gradient monitoring wells at the landfill site. Typical monitoring well schematics, and logs of the borings performed are attached in Appendix J.

In 1988, James M. Montgomery Consulting Engineers, Inc. performed a detailed assessment of the groundwater at the site which included placing eight additional ground water monitoring wells (JMM-1 through JMM-8), and seven deeper piezometers (P-1 through P-5, and P-7 & P-8) at the site. All piezometers are located within 15 feet of a shallow monitoring well for the purpose of determining the presence and magnitude of upward artesian pressure in the deeper water bearing zones. JMM consultants described the rationale used in determining monitoring well locations as follows:

MONITORING WELL DESIGNATION	RATIONALE
JMM-1	Characterize shallow upgradient ground water quality at a distance from the south side of the landfill.

JMM-2	Examine shallow upgradient ground water quality adjacent to the southwest landfill property corner.
JMM-3	Characterize shallow upgradient ground water quality at a distance from the east side of the landfill.
JMM-4	Examine shallow ground water quality along the east side of the landfill property.
JMM-5	This well is screened in the refuse. It's purpose is to characterize the chemical composition of the groundwater in the refuse for comparison with other wells at the landfill.
JMM-6	Examine shallow down gradient ground water quality along the west boundary of the landfill property.
JMM-7	Examine shallow down gradient ground water quality along the north boundary of the landfill property.

JMM-8	Examine shallow down gradient groundwater quality at the northeast property corner.

Commonly accepted practice was employed in placing the above described wells. Based on the serviceability of the wells over the past several years, this appears to be the case. Silt in the wells is minimal, and there appears to be no surface contamination of the ground water due to improper installation of the wells. Typical monitoring well schematics, and logs of the borings performed by JMM in 1988 are attached in Appendix J.

Several consultants have prepared reports dealing with the geology and hydrogeology at and around the landfill site. Considerable time has been spent in reviewing the well schematics, boring logs, and soil profiles from these reports. This review produced several concerns about the data provided by previous sampling and testing of groundwater. These concerns included the following: 1.) that some of the wells on site are actually be placed through refuse, 2.) that other wells may be placed through refuse, but the boring logs are unclear on this fact, 3.) that the wells may not all be screened in the same water bearing zone, and 4.)that the upgradient wells are placed at large distances from the landfill boundary. Based on these concerns the decision was made to place one new upgradient well at the landfill boundary, and two new down gradient wells well outside of the area where any refuse is placed. Well Schematics for these and boring logs for the new wells are attached in Appendix J. Every effort was made to ensure that the concerns of the previous wells were addressed in the new wells. The three new wells are used as background and compliance points.

The groundwater protection standard for arsenic was historically 0.05 mg/L. This was reduced downward to 0.01 mg/L in 2006. In 2009, an exceedance of the new standard was found in a compliance well. As part of an effort to determine whether arsenic in the groundwater is naturally-occurring, two additional wells were installed side-gradient to the compliance wells and out of influence of the landfill: BG-1 and BG-2. Bountiful City submitted a report to the Division demonstrating that arsenic concentrations in the facility's compliance wells are naturally-occurring, which was accepted by the division in a letter dated May 11, 2011. Shortly thereafter, the city requested alternate groundwater protection standards for arsenic and proposed some additional sampling of these new wells (BG-1 and BG-2) for future evaluations of alternate groundwater protection standards.

The ground water monitoring wells, and deep piezometers surrounding the landfill site appear to be sufficient to determine ground water quality and parameters of the aquifers as needed. If it is determined that additional monitoring wells are necessary at the site, installation plans and specifications will be prepared and submitted.

ENGINEERING REPORT

Refuse disposal operations at the location of the Bountiful Sanitary Landfill began around 1960. At that time minimal considerations were given to environmental concerns in landfill design, planning and operation at the site. The site was operated for many years as an open dump. Later large trenches were excavated and filled with refuse. Open burning was allowed, and refuse was accepted from most of South Davis County. In the late 1970's and 1980's as landfill regulations began to be proposed and implemented nationwide the area began receiving attention from environmental regulatory agencies such as the U.S. Environmental Protection Agency and the Davis County Health Department. Groundwater monitoring at the site began in 1985 by the Davis County Health Department. In 1987, when Bountiful City became the sole owner/operator of the site, improvements at the site began which would bring the landfill into compliance with State and Federal Solid Waste Permitting and Management Rules and would eventually lead to the Bountiful Sanitary Landfill obtaining a Permit from the Department of Environmental Quality Division of Solid and Hazardous Waste (DEQDSHW) to operate a Class I Sanitary Landfill. In 1988 landfill operators retained the services of James M. Montgomery Consulting Engineers, Inc. (JMM) to perform a detailed groundwater analysis at the site. Over the next several years site improvements and operation enhancements were implemented. Based on our Permit Application and proposed Plan of Operations at the Bountiful Sanitary Landfill the City of obtained a permit to operate a Class I Landfill from the DEQDSHW in June of 2000.

The City currently operates the landfill in compliance with the State of Utah Department Environmental Quality, Division of Waste Management and Radiation Control, Solid Waste Permitting and Management Rules (R315-301 through 320). Continued operation of the Bountiful Sanitary Landfill as currently operating and in compliance with the Plan of Operation will accomplish the goal of ensuring environmentally sound landfill operations in the future.

Location Standards

Because the Bountiful Sanitary Landfill is an "existing facility", the location standards for new facilities do not apply. However, Bountiful Sanitary Landfill is in general compliance with the majority of these standards even though it is not required. The areas specifically excluded from the exception for existing facilities are location standards pertaining to airports, unstable areas, and floodplains.

Airports. The nearest airport to the Bountiful Sanitary Landfill is the Sky Park Air Field located in Woods Cross, Utah. The North end of the runway for this small airport is located approximately 2.4 miles south of the south border of the Bountiful Sanitary Landfill. This airport services only piston type aircraft. No turbojet aircraft use this air strip. Birds attracted by landfill operations will not interfere with aircraft from this airport.

The north end of the runway at the Salt Lake International Airport is located approximately 8 miles south of the south border of the Bountiful Sanitary Landfill. This airport is used by many types of aircraft including large turbojets. Due to the distance of the runway from the landfill, interference of birds attracted by the landfill with aircraft is not likely.

Unstable Areas. Based on several Geological and Geotechnical reports performed in the area of the Bountiful Sanitary Landfill, and based on the definition of an “unstable area” in the Solid Waste Permitting and Management Rules, the Bountiful Sanitary Landfill is not in an unstable area.

The site is flat, and lack of stability of natural slopes is not a problem. Slope stability analyses were performed on slopes produced by landfilling operations. Initial slope stability analysis was performed assuming final embankment slopes of 20% with conservative input values for cohesion and friction angle, and showed a minimum Factor of Safety (FS) of 2.250 under static conditions. Updated slope stability analysis was performed in 2021 for final slopes of 3:1. The 2021 study relied on soil borings and lab testing performed from on-site samples, along with other research on local soil and waste properties. This study shows a static FS of 2.3.

Additional slope stability analysis was performed in 2021 assuming a Geosynthetic Clay Liner (GCL) final cover with locally stockpiled soil used to cover the liner, at a final slope of 3:1. Cover soil characteristics were determined from samples taken of on-site stockpiles. This study found the minimum FS of soil-liner interfaces to be 1.48. Reports of both of these studies, performed by IGES, are included in Appendix L.

As discussed in the section of this application entitled “Geohydrological Assessment Report,” the Bountiful Sanitary Landfill is in a seismic impact zone. However, because the landfill is an existing facility, regulations relating to seismic impact zones do not apply. Even so, in order to better understand impacts of seismic activity, pseudo-static analysis of the landfill slopes under the same conditions as those described above, but including the added force which would be applied by earthquake movement. In a pseudo-static analysis, the horizontal seismic acceleration is conservatively assumed to be both undirectional and constant in its application, like a static dead load. In fact, the seismic accelerations and resultant forces act in multiple directions with varying intensities over the period of the seismic event. Since the varying intensities of the seismic loads tend to be less than the loads resulting from the assumed peak accelerations, assuming a constant loading equivalent to the peak acceleration is a very conservative assumption. A seismic force was applied in the model as described in aforementioned slope stability analysis reports. The overall embankments have a pseudostatic FS of 0.7, with ground displacements greater than 1 meter estimated that would need repair. This would also affect the GCL with displacements approaching 1.0 meter estimated that may damage the GCL cover system and would need repair.

The thick saturated clay layers at the site are subject to consolidation when the soil overburden pressure is increased. Therefore as the refuse fill at the site progresses, settlement is anticipated. In an attempt to ensure proper runoff of storm water from the landfill surface, final slopes have been designed to tolerate consolidation of sub-layers, and still maintain proper slope. Also, quarterly inspections will include a check of slopes and cover to detect unacceptable amounts of settling. Any noted settlement will be immediately repaired. Any cracks developed in the cover due to settlement will also be immediately repaired.

Floodplains. As discussed earlier, the Bountiful Sanitary Landfill is located east of the east shore of the Great Salt Lake. In the early to mid 1980's the level of the lake rose substantially to levels which caused it to nearly surround the landfill. All sides were bordered by lake water except the southeast corner of the landfill in the area of the entrance gate. Improvements to the landfill site during this time proved effective in preventing washout of solid waste from the landfill site. The improvements at the site included building and upgrading berms and dikes around the landfill, and providing rip-rap material to prevent erosion. These dikes and berms are maintained in good condition in order to remain prepared should the level of the lake rise as it did in the early to mid 1980's.

Landfill Design and Operation

The Bountiful Sanitary Landfill has been designed by employing current and commonly accepted engineering practice. The facility is designed to provide economical disposal of the solid waste generated within the limits of Bountiful City and to provide both economical and environmentally sound landfill operation. This is accomplished by complying with the landfill specifications and design parameters, and following the Plan of Operation contained in this permit application.

Cell Design. Landfill cells have been designed to maximize available space, to provide easy access to the working face for equipment and haul vehicles, and minimize run-on to the active landfill face. Run-on and run-off control have been considered.

Fill at the Bountiful Sanitary Landfill will be performed using a modified area fill method. The modification is due to the desire to make use of any available cover material used previously in providing interim soil cover and run-off measures. In areas where more than one foot of cover material is available for recovery, a trench will be excavated to the bottom of the excess cover material prior to placing the initial lift of refuse. The soil excavated will be stockpiled and subsequently reused for interim and final cover on the new lifts. This will occur on the first lift in each area of the landfill. The remainder of the lifts will employ standard area fill procedures.

A cell will consist of one lift ranging in thickness from ten feet thick on the east edge of the landfill and tapering on a slope of 1% or greater to meet the existing grade on the west end. This will provide drainage away from the active face, and will allow drainage toward the run-off retention pond located on the west edge of the landfill.

General Daily Operation. Refuse delivered to the landfill site first undergoes initial screening at the scale to determine if any suspicious, or hazardous materials are present, and to determine if any portion of the load can be deposited in the recycling bins, branch chipping pile or composting areas. If nothing is noted that requires special handling procedures or further inspection, the load is weighed, and directed to the working face of the landfill to be unloaded. All refuse is placed at the toe of the active face of the landfill, and landfill personnel and equipment spread the refuse in layers of approximately two to three feet thick. Each layer is compacted by approximately 3-5 passes over the refuse with compaction equipment. Daily cover consists of six inches of compacted soil or other approved alternative cover, which will be placed over the active face at the end of each working day. Detailed operating procedures are outlined in the attached "Plan of Operations", and "Landfill Specifications".

Cover Soil. Soil for daily and interim cover at the landfill is imported to the site by landfill operators or other haulers. Landfill operators accept clean soil delivered to the site and placed as requested by the on-site supervisor in useable quantities. If additional soil is needed for daily or interim cover for landfill operations, Bountiful City personnel and equipment transport and place the soil.

Interim cover is placed at the top of each lift, consisting of an additional six inches of soil for a total interim cover thickness of 12 inches. This cover is placed on all areas which are to receive at least one additional lift of refuse prior to receiving final cover. The soil for interim cover comes from the same source as does the daily cover.

Final cover soil will be obtained from on-site stockpiles. Large quantities of low permeability clay were excavated from an area south of the landfill. Much of this soil was used as interim cover and to provide positive drainage on the south half of the landfill and can be reclaimed for use as cover. Some of the soil was stock piled on site for use as final cover and to construct the dikes in the storm water retention pond. Initially, approximately 640,000 cubic yards were excavated for use at the landfill. Currently approximately 400,000 cubic yards are available for use as final cover, nearly all of which would need to be reclaimed from the interim cover on the south half of the landfill.

Soil Liner. Because the Bountiful Sanitary Landfill is an existing facility, an engineered liner at the site is not required. However, the natural low permeability soil underlying the landfill serves as a liner, and prevents the vertical migration of onate from the landfill. The permeability of the natural clay liner which underlies the Bountiful Sanitary Landfill was determined by laboratory testing of undisturbed samples. These tests determined the in place permeability of the soil to be approximately 10^{-8} cm/s.

Leachate Collection, Treatment, and Disposal System. Because no liner is required at the landfill, no leachate collection, treatment or disposal is currently planned at the site. Improved run-on and run-off control, combined with the relatively dry climate will minimize the potential for leachate production and migration.

Run-on/Run-off Control System. A run-off collection pond designed to retain the runoff from the active face of the landfill during a 24 hour 25 year storm has been designed and constructed at the landfill. Refuse fill areas and cover will be constructed and graded to drain away from the active face of the landfill. All runoff from the active face of the landfill will be collected and drained to the run-off collection pond.

The run-off collection pond is constructed of low permeability clay soil obtained on site. This soil has been compacted and tested in the laboratory. The permeability of the soil was determined to be 1.2 x 10^{-7} cm/sec. when compacted to 95% of maximum density as determined by a Standard Proctor. At least two feet of compacted soil constitutes the pond liner. All run-off water retained by the pond will be allowed to evaporate. No run-off water from the active face will be released from the landfill site.

Closure and Post Closure Design. The closure and post-closure plans have been designed in accordance with applicable design parameters of the Division of Was Administrative Rules.

The intent of the closure plan design is to minimize the need for maintenance, minimize the threat to human health and the environment from post closure escape of solid waste constituents, leachate, landfill gasses, contaminated runoff or waste decomposition products to the ground, ground water, and surface water, and to prepare the facility for the post closure period.

The intent of the post closure plan design is to provide continued facility maintenance and monitoring of gasses, land, and ground water, and to provide for timely maintenance of noted deterioration or wear of any of the protective or monitoring systems.

Detailed descriptions of the closure, and post closure plans are found in the " General Report" section of this application.

Currently, nearly all of the property surrounding the landfill is owned by Bountiful City. That which is not owned by Bountiful City is zoned by Davis County as A-10 (Agriculture and Farm Production). No decision has been established relating to future use of the landfill site, but some speculation indicates recreational uses are anticipated. It is not anticipated that any change in ownership will be necessary upon completion of closure and post closure activities.

Attachment 3

Record Keeping Forms

Ticket Report

Batch Summary

```
Ticket #     Date    Time  Reference  Account    Customer        Vehicle    Material       Quantity          Rate          Amount

                                        # OF TICKETS                             123
                                        # OF RECORDS                             126
                                        # OF CUSTOMERS                            25
                                        # OF TRUCK PERMITS                        10
                                        TOTAL VOLUME                               0
                                        AVG. CU YD/LOAD                         0.00
                                        INBOUND WEIGHT                        215.74
                                        OUTBOUND WEIGHT                         1.31
                                        TOTAL WEIGHT                          217.05
                                        AVG. TON/LOAD                           1.72
                                        CHARGE SALES                        4,488.00
                                        CASH SALES                          1,254.00
                                        NET SALES                           5,742.00
                                        PAYMENTS ON ACCOUNT                     0.00
                                        CASH RECEIVED                         343.00
                                        CHECKS RECEIVED                         0.00
                                        BANK CARD CHARGES                     911.00
                                        TOTAL COLLECTIONS                   1,254.00
                                        AMOUNT PAID OUT                         0.00
                                        TAX: Sales Tax                          3.10


                                                  BATCH CLOSE PRINTED:
                                                  Site 022    11/10/2022    16:55:22    KERRIF
```

Date 11/10/22
Time 16:59:22

Bountiful, City of, UT

General Ledger Distribution Report

For the period 11/10/2022 - 11/10/2022
Sites: 1, 2, 22
Accounts 000000 - 999999 Types - Z
Including: Cash Sales Cash Adjs Pymts on Acct

General Ledger Account	Cash	A/R	Sales	GL Amount
Accounts Receivable		0.00		0.00
Receipts	1,254.00			1,254.00
57 377300			-405.00	-405.00
57 377100			-165.00	-165.00
57 377100			-278.00	-278.00
57 377900			-40.00	-40.00
57 377300			-366.00	-366.00
	----------------	----------------	----------------	----------------
	1,254.00	0.00	-1,254.00	0.00

Ticket Report

Bank Card Register

Ticket # Date Time Reference Account Customer Vehicle Material Quantity Rate Amount

CUSTOMER	REFERENCE	BANKCARD	TICKET	AMOUNT
CASH CUSTOMER		CC	400397	5.00
CASH CUSTOMER		CC	400403	15.00
CASH CUSTOMER		CC	400404	5.00
CASH CUSTOMER		CC	400411	20.00
CASH CUSTOMER		CC	400412	10.00
CASH CUSTOMER	DUMPS	CC	400413	20.00
CASH CUSTOMER		CC	400417	20.00
CASH CUSTOMER		CC	400421	10.00
CASH CUSTOMER		CC	400422	20.00
CASH CUSTOMER		CC	400426	30.00
CASH CUSTOMER		CC	400431	5.00
CASH CUSTOMER		CC	400433	5.00
CASH CUSTOMER		CC	400434	5.00
CASH CUSTOMER		CC	400435	5.00
CASH CUSTOMER	BRON	CC	400442	243.00
CASH CUSTOMER	MARK	CC	400445	45.00
CASH CUSTOMER		CC	400448	5.00
CASH CUSTOMER		CC	400449	5.00
CASH CUSTOMER		CC	400457	5.00
CASH CUSTOMER		CC	400462	10.00
CASH CUSTOMER		CC	400468	35.00
CASH CUSTOMER	BIG BLACK	CC	400472	22.00
CASH CUSTOMER		CC	400473	5.00
CASH CUSTOMER		CC	400474	15.00
CASH CUSTOMER		CC	400477	15.00
CASH CUSTOMER		CC	400480	5.00
CASH CUSTOMER		CC	400481	10.00
CASH CUSTOMER	WHT F350	CC	400483	71.00
CASH CUSTOMER		CC	400484	20.00
CASH CUSTOMER		CC	400489	35.00
CASH CUSTOMER		CC	400493	15.00
CASH CUSTOMER		CC	400502	15.00
CASH CUSTOMER		CC	400503	20.00
CASH CUSTOMER		CC	400504	30.00
CASH CUSTOMER		CC	400505	15.00
CASH CUSTOMER		CC	400507	30.00
CASH CUSTOMER		CC	400508	20.00
CASH CUSTOMER		CC	400510	20.00
CASH CUSTOMER		CC	400511	15.00
CASH CUSTOMER		CC	400513	10.00

Bountiful, City of, UT

Ticket Report

Bank Card Register

Ticket #	Date	Time	Reference	Account	Customer	Vehicle	Material	Quantity	Rate	Amount
									911.00	

Date 11/21/22
Time 10:54:23

City of Bountiful, UT

Customer Financial Summary Report

11/18/2022 through 11/18/2022
Sites: 1, 2, 22
Accounts 000000 - 999999 Customer types - Z Weighmasters - zzzzzzzzzz Reference - zzzzzzzzzz
Including: Cash Sales Chg Sales Cash Adjs Chg Adjs

Date	Ticket	Weighmaster	Customer	Reference	Vehicle	Roll-off	Amount
			0 CASH CUSTOMER				1866.00
			2 ACE DISPOSAL				804.00
			14 BRODERICK CONSTRUCTION				20.00
			18 ATLAS DISPOSAL OF UTAH, LLC				281.00
			47 JMR CONSTRUCTION				15.00
			63 ALL SEASONS LANDSCAPING INC.				20.00
			68 WASTE MANAGEMENT				1043.00
			90 SOUTH DAVIS SEWER DISTRICT				506.00
			100 BOUNTIFUL CITY SANITATION				0.00
			105 TERRAWORKS				15.00
			110 ROBINSON WASTE SERVICE, INC.				393.00
			127 SIMMS YARD CARE, INC.				18.00
			143 MOLLERUP GLASS COMPANY				143.00
			157 FOXWOOD INC.				20.00
			193 SEASONS FOUR LANDSCAPE & MAINT				60.00
			196 HABITAT PRESERVE/WILD BILL				45.00
			220 RAYMOND KELLER CONST. CO.				20.00
			250 C&C CONSTRUCTION CONTAINERS				310.00
			258 GREENSCAPES LAWN & LANDSCAPING				69.00
			261 LARKIN LANDSCAPING				224.00
			280 AZTEC LANDSCAPING, LLC				15.00
			296 COMPLETE MAINTENANCE				30.00
			297 R8 CONSTRUCTION				29.00
			300 CEMETERY				0.00
			306 WATER DEPARTMENT				0.00

							5946.00

	# OF TICKETS	**%**	**NET AMOUNT**
CASH SALES	130	70.65	1866.00
CHARGE SALES EXCLUDING LATE FEES	38	20.65	4080.00
CASH ADJUSTMENTS	0	0.00	0.00
CHARGE ADJUSTMENTS EXCLUDING LATE FEES	0	0.00	0.00
NO CHARGE SALES	16	8.70	0.00
	----------	-----	------------
	184	**100.00**	**5946.00**

Material Analysis Report by Material

Inbound and outbound materials for the period 11/18/2022 - 11/18/2022
Summary Report for Sites: 1, 2, 22
Accounts 0 - 999999 Customer Types - Z Materials - ZZZZZZZZZZ Material Types - ZZ

Date	Material	Type	Customer	Type	Tickets	Count	Est. vol.	Act. Vol.	Est. Wt.	Actual Wt.	Charge
	BCW			Total	10	0	124900	0	62.45	62.45	0.00
				Average		0	12490	0	6.25	6.25	0.00
	CITY-DIRT			Total	2	2	24000	0	12.00	0.00	0.00
				Average		1	12000	0	6.00	0.00	0.00
	CITY-MW			Total	4	4	40000	0	20.00	0.00	0.00
				Average		1	10000	0	5.00	0.00	0.00
	COMP			Total	3	0	19880	0	9.94	9.94	349.00
				Average		0	6627	0	3.31	3.31	116.33
	CONST			Total	10	0	24840	0	12.42	12.42	497.00
				Average		0	2484	0	1.24	1.24	49.70
	DIRT			Total	3	0	0	0	2.15	2.15	79.00
				Average		0	0	0	0.72	0.72	26.33
	GW-COM			Total	26	0	46580	0	23.29	23.29	513.00
				Average		0	1792	0	0.90	0.90	19.73
	GW-RES			Total	37	42	42000	0	21.00	0.00	210.00
				Average		1	1135	0	0.57	0.00	5.68
	HH			Total	55	65	65000	0	32.50	0.00	325.00
				Average		1	1182	0	0.59	0.00	5.91
	MATTRESS			Total	4	5	750	0	0.39	0.00	75.00
				Average		1	188	0	0.10	0.00	18.75
	MW			Total	27	0	168220	0	84.11	84.11	3,372.00
				Average		0	6230	0	3.12	3.12	124.89
	REFRIG/FRE			Total	1	1	0	0	0.00	0.00	20.00
				Average		1	0	0	0.00	0.00	20.00
	SLUDGE			Total	2	0	50560	0	25.28	25.28	506.00
				Average		0	25280	0	12.64	12.64	253.00
				Report Total	**184**	**119**	**606730**	**0**	**305.53**	**219.64**	**5,946.00**

Material Analysis Report by Material

Inbound and outbound materials for the period 11/18/2022 - 11/18/2022
Summary Report for Sites: 1, 2, 22
Accounts 0 - 999999 Customer Types - Z Materials - ZZZZZZZZZZ Material Types - ZZ

Date	Material	Type	Customer	Type	Tickets	Count	Est. vol.	Act. Vol.	Est. Wt.	Actual Wt.	Charge
				Report Average		1	3297	0	1.66	1.19	32.32

BOUNTIFUL, UT 84010

DUPLICATE TICKET reprinted by SDEMARCO at 11:03:54 on 11/21/22 **

Account # 68		Site	022
WASTE MANAGEMENT		Ticket	00401438
		Date In	11/18/22
ATTN:MICHELLE SLY		Time In	08:06:00
PORTLAND	OR 97208-4745	Date Out	11/18/22
		Time Out	08:13:59

Weigh master: CPETERS
Ref. 503

Origin
Grid

DESCRIPTION

Scale 1		37780 LB	Vehicle	
Scale 2	Tare Wt.	36460 LB	Roll-Off	
Net Wt.		1320 LB	TON	0.66

Mixed Waste	@ $40.00 per TON	26.00

Sales Tax	0.00
Total Charge Amount	26.00

Sludge

Summer Hours from Apr. 1 to Nov. 1 -- 8:00 a.m. to 6:00 a.m.
Winter Hours from Nov. 1 to Apr. 1 -- 8:00 a.m. to 5:00 p.m.

ignature ____

BOUNTIFUL SANITARY LANDFILL
795 SOUTH MAIN STREET
BOUNTIFUL, UTAH 84010

Weighed: Jeff
Deposit: Jeff
BILL TO: 2
ACE DISPOSAL
P O BOX 2608
SALT LAKE CITY UT 84110

Vehicle ID:
Reference:

DATE IN: 11/01/2022 TIME IN: 12:24:23
DATE OUT: 11/01/2022 TIME OUT: 12:32:08

INBOUND TICKET Number: 22-00399294

SCALE 1 GROSS WT.	36020 LB
SCALE 2 TARE WT.	35120 LB
NET WEIGHT	900 LB

Qty	Description	Amount
0.45	Mixed Waste	20.00

TICKET AMOUNT: 20.00

X______________________________

BOUNTIFUL SANITARY LANDFILL
795 SOUTH MAIN STREET
BOUNTIFUL, UTAH 84010

Weighed: Jeff
BILL TO: 0
CASH CUSTOMER

Vehicle ID:
Reference:

DATE IN: 11/01/2022 TIME IN: 16:56:31
DATE OUT: 11/01/2022 TIME OUT: 16:56:31

INBOUND TICKET Number: 22-00399399

STORED GROSS WT.	0 LB
STORED TARE WT.	0 LB
NET WEIGHT	0 LB

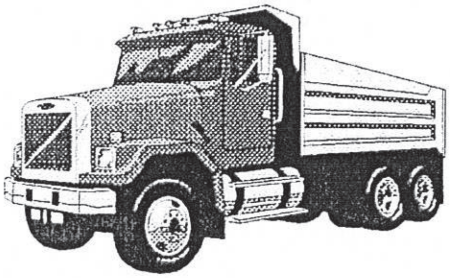
Qty	Description	Amount
1.00	Resident Green Waste	5.00

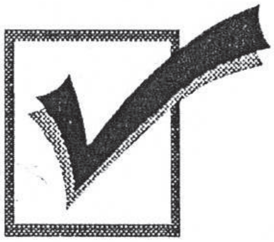
TICKET AMOUNT: 5.00
AMT. TENDERED: 5.00
CHANGE AMOUNT: 0.00

X______________________________

NOTICE !

RANDOM WASTE SCREENING IS PRACTICED HERE!





WE RESERVE THE RIGHT TO INSPECT ANY LOAD OR PORTION OF A LOAD ARRIVING AT OUR FACILITY.

WE WILL REJECT ALL:
HAZARDOUS WASTE
PCBs
LIQUIDS
RADIOACTIVE WASTE
AND

ANY WASTES DETERMINED UNACCEPTABLE BY OUR MANAGEMENT!

YOUR PARTICIPATION IN THIS PROGRAM IS NOT OPTIONAL!

LOAD INSPECTIONS

WEEK OF:____

Sunday	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**
Inspector:	Inspector:	Inspector:	Inspector:	Inspector:	Inspector:	Inspector:
Vehicle:	Vehicle:	Vehicle:	Vehicle:	Vehicle:	Vehicle:	Vehicle:
Driver:	Driver:	Driver:	Driver:	Driver:	Driver:	Driver:
Type of Waste:	**Type of Waste:**	**Type of Waste:**	**Type of Waste:**	**Type of Waste:**	**Type of Waste:**	**Type of Waste:**
☐ MSW ☐ C&D ☐ Greenwaste ☐ Soil ☐ Other (Describe): __________ __________	☐ MSW ☐ C&D ☐ Greenwaste ☐ Soil ☐ Other (Describe): __________ __________	☐ MSW ☐ C&D ☐ Greenwaste ☐ Soil ☐ Other (Describe): __________ __________	☐ MSW ☐ C&D ☐ Greenwaste ☐ Soil ☐ Other (Describe): __________ __________	☐ MSW ☐ C&D ☐ Greenwaste ☐ Soil ☐ Other (Describe): __________ __________	☐ MSW ☐ C&D ☐ Greenwaste ☐ Soil ☐ Other (Describe): __________ __________	☐ MSW ☐ C&D ☐ Greenwaste ☐ Soil ☐ Other (Describe): __________ __________
Suspicious Items:	**Suspicious Items:**	**Suspicious Items:**	**Suspicious Items:**	**Suspicious Items:**	**Suspicious Items:**	**Suspicious Items:**
☐ Sealed Containers ☐ Dry Chemicals ☐ Other (Describe): __________ __________	☐ Sealed Containers ☐ Dry Chemicals ☐ Other (Describe): __________ __________	☐ Sealed Containers ☐ Dry Chemicals ☐ Other (Describe): __________ __________	☐ Sealed Containers ☐ Dry Chemicals ☐ Other (Describe): __________ __________	☐ Sealed Containers ☐ Dry Chemicals ☐ Other (Describe): __________ __________	☐ Sealed Containers ☐ Dry Chemicals ☐ Other (Describe): __________ __________	☐ Sealed Containers ☐ Dry Chemicals ☐ Other (Describe): __________ __________
Prohibited Items:	**Prohibited Items:**	**Prohibited Items:**	**Prohibited Items:**	**Prohibited Items:**	**Prohibited Items:**	**Prohibited Items:**
☐ Tires ☐ Liquids ☐ Asbestos ☐ Flammable/ Corrosive/ Reactive/ Ignitable ☐ Dry Chemicals	☐ Tires ☐ Liquids ☐ Asbestos ☐ Flammable/ Corrosive/ Reactive/ Ignitable ☐ Dry Chemicals	☐ Tires ☐ Liquids ☐ Asbestos ☐ Flammable/ Corrosive/ Reactive/ Ignitable ☐ Dry Chemicals	☐ Tires ☐ Liquids ☐ Asbestos ☐ Flammable/ Corrosive/ Reactive/ Ignitable ☐ Dry Chemicals	☐ Tires ☐ Liquids ☐ Asbestos ☐ Flammable/ Corrosive/ Reactive/ Ignitable ☐ Dry Chemicals	☐ Tires ☐ Liquids ☐ Asbestos ☐ Flammable/ Corrosive/ Reactive/ Ignitable ☐ Dry Chemicals	☐ Tires ☐ Liquids ☐ Asbestos ☐ Flammable/ Corrosive/ Reactive/ Ignitable ☐ Dry Chemicals
Conforming Waste: ☐ YES ☐ NO	**Conforming Waste:** ☐ YES ☐ NO	**Conforming Waste:** ☐ YES ☐ NO	**Conforming Waste:** ☐ YES ☐ NO	**Conforming Waste:** ☐ YES ☐ NO	**Conforming Waste:** ☐ YES ☐ NO	**Conforming Waste:** ☐ YES ☐ NO
Comments/Follow-Up (more on back) __________ __________ __________	Comments/Follow-Up (more on back) __________ __________ __________	Comments/Follow-Up (more on back) __________ __________ __________	Comments/Follow-Up (more on back) __________ __________ __________	Comments/Follow-Up (more on back) __________ __________ __________	Comments/Follow-Up (more on back) __________ __________ __________	Comments/Follow-Up (more on back) __________ __________ __________

BOUNTIFUL SANITARY LANDFILL
QUARTERLY INSPECTION REPORT

Date:

Groundwater Monitoring system:
Locks
Protective Covers
Guard Posts
Total depths
Other

Methane Monitoring System:
Equipment Calibration

Equipment Operation

Other

Runoff retention system:
Berm Condition

Runoff Transport Ditch Condition

Erosion Concerns

Topsoil and vegetation condition

Other

Deviations from approved plan of operation:

Other Comments:

BOUNTIFUL SANITARY LANDFILL

METHANE GAS MONITORING

DATE:_______________________

LOCATION	METHANE CONCENTRATION (%)	PERCENT LOWER EXPLOSIVE LIMIT (%LEL)
Office_______________		
Office_______________		
Shop________________		
Shop________________		
Scale House		
North Boundary		
South Boundary		
East Boundary		
West Boundary		
Well DC-1		
Well DC-2		
Well DC-3		
Well DC-4		
Well JMM-1		
Well JMM-2		
Well JMM-3		
Well JMM-4		
Well JMM-5		
Well JMM-6		
Well JMM-7		
Well JMM-8		
Well BSL-1		
Well BSL-2		
Well BSL-3		

Drainage System Inspection Form
Bountiful Sanitary Landfill

Inspector(s):____Date:___________________

Current Weather Conditions:______________________ Last 24 Hours:_________________

	OK	Not OK	Condition, Corrective Action, General Notes
Site Access			
Soil Stabilization			
Conveyances Stable			
Water Management			
Outlet Protection			

Drainage System Inspection Form
Bountiful Sanitary Landfill

	OK	Not OK.	Condition, Corrective Action, General Notes
Storm Water Detention and Monitoring			
Maintenance			
Dust Control			
Spill Prevention			
Condition of Discharge Water If applicable			

Comments:

STORM WATER DISCHARGE MONITORING REPORT (SWDMR)

IDENTIFICATION & LOCATION

Name Bountiful City

Permit No. UTR 000725

Mailing Address:

795 S. Main St.
Bountiful, UT 84010

Site Location (if different)

Bountiful Sanitary Landfill
1300 W. 1600 N
West Bountiful, UT 84087

Monitoring Period:

From: Month______ Day ______ Year ________

To: Month______ Day ______ Year ________

Total Storm Water Discharge Points 1

Number assigned to this Discharge Point 1

INDUSTRY SECTOR(s)

Industrial Activities or Industry Sector(s) Drained by this Discharge:

- **A. Timber Products Facilities**
- **B. Paper and allied Products Manufacturing Facilities.**
- **C. Chemical and allied Products Manufacturing Facilities.**
- **D. Asphalt paving, Roofing materials, and Lubricant Manufacturing Facilities.**
- **E. Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturing Facilities.**
- **F. Primary Metals Facilities.**
- **G. Metal Mines (Ore Mining and Dressing).**
- **H. Coal Mines and Coal Mine-Related Facilities.**
- **I. Oil or Gas Extraction Facilities.**
- **J. Mineral Mining and Processing Facilities.**
- **K. Hazardous Waste Treatment Storage or Disposal Facilities.**
- **[✓ L.] Landfills and Land Application Sites.**
- **M. Automobile Salvage Yards.**
- **N. Scrap Recycling and Waste Recycling Facilities.**
- **O. Steam Electric Power Generating Facilities.**
- **P. Motor Freight transportation Facilities, Passenger Transportation Facilities, Petroleum Bulk Oil Stations and Terminals, the United States Postal Service , or Railroad Transportation Facilities.**
- **Q. Vehicle Maintenance Areas and Equipment Cleaning Areas of Water Transportation Facilities.**
- **R. Ship or Boat Building and Repair Yards.**
- **S. Vehicle Maintenance Areas, Equipment Cleaning Areas or Airport Deicing Operations located at Air Transportation Facilities.**
- **T. Wastewater Treatment Works.**
- **U. Food and Kindred Products Facilities.**
- **V. Textile Mills, Apparel and Other Fabric Product Manufacturing Facilities.**
- **W. Furniture and fixture manufacturing Facilities.**
- **X. Printing and Publishing Facilities.**
- **Y. Rubber and Miscellaneous Plastic Product Manufacturing Facilities.**
- **Z. Leather Tanning and Finishing Facilities**
- **AA. Facilities That Manufacture Metal Products including Jewelry, Silverware and Plated Ware..**
- **AB. Facilities That Manufacture Transportation Equipment, Industrial or Commercial Machinery.**
- **AC. Facilities That Manufacture Electronic and Electrical Equipment and Components, Photographic and Optical Goods.**
- **AD. Non-Classified Facilities**

ANALYTICAL MONITORING DATA (For sectors where it is required)

Storm Event: ***All samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. This data must be submitted to the Division of Water Quality.***

Please circle if there has been no data or discharge of Storm Water during this reporting period. (If none please explain in comment section)	• **No Data**

Date of Storm Event	**Month Day Year**
Duration of Storm Event	**Hours**
Rain Fall Measurement	**Inches**
Time elapsed Between Recorded & Previous Storm Event	**Days**
Estimated Total Volume of Discharge *(Include units; gal., etc.)*	

Sample Type: ***Data shall be reported for a grab sample taken during the first thirty minutes of the discharge. If the collection of a grab sample during the first thirty minutes is impracticable, a grab sample can be taken during the first hour of the discharge, and the discharger shall submit with the monitoring report a description of why a grab sample during the first thirty minutes was impracticable.***

Parameter	**Effluent Limit** *(If Applicable)*	**Concentration** *(Concentration quantity, for example -14.2)*	**Units** *(Example – mg/L)*

SIGNATURE

Name/Title Principle Executive Officer
(Typed or Printed)

Gary Hill, City Manager

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See 18 U.S.C. 1001 and 33 U.S.C. 1319. (penalties under these statues may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)

Signature of Principle Executive Officer or Authorized Agent

Date

Comments:

VISUAL MONITORING REQUIREMENTS

Sample and Data Collection:	*Examinations shall be made of samples collected within the first 30 minutes (or as soon thereafter as practical, but not to exceed one hour) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution. The examination must be conducted in a well lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable the same individual will carry out the collection and examination of discharges for the life of the permit.*

COLOR (Circle the ones that apply):

1. Identification of Color.

Black Dark Grey Medium Grey Light Grey Dark Chocolate Brown Medium Brown

Light Brown Tan Yellow Green Other________________________________

2. Intensity of Color. Very intense Prominent Moderately Perceptible Hardly Perceptible

Comments: ____

____

____

CLARITY (Circle the right one):

Totally Opague Slightly Translucent Translucent Nearly Transparent Transparent

ODOR (Circle the ones that apply):

Diesel Gasoline Petroleum Solvent Musty Sewage Chlorine

Rotten Egg Sulfur No Odor Noxious Other ____________________

Comments: ____

____

____

____

SOLIDS

Floating Solids: (Description) ____

____

____

____

Suspended and Settled Solids: (Description) ____

____

____

____

FOAM, OIL SHEEN, OR OTHER OBVIOUS INDICATORS OF POLLUTION

____

____

____

____

____

____

____

____

____

____

____

____

Attachment 4

Demonstration of Naturally Occurring Arsenic

Geosyntec
consultants

215 South State Street, Suite 500
Salt Lake City, UT 84111
PH 801.853.8185
FAX 714.969.0820
www.geosyntec.com

February 17, 2022

Mr. Todd Christensen
Assistant City Engineer
Bountiful City
795 North Main Street
Bountiful, UT 84010

**Subject: 5-Year Review of Alternative Groundwater Protection Standards for Arsenic
Bountiful Sanitary Landfill
Bountiful, Utah**

Dear Mr. Christensen:

On behalf of Bountiful City, Geosyntec Consultants, Inc. (Geosyntec) has completed a 5-year review of the alternate groundwater protection standards (GWPSs) for arsenic developed for compliance monitoring wells BSL-2 and BSL-3 at the Bountiful Sanitary Landfill (Landfill) in Bountiful, Utah. The alternate GWPSs for these wells were approved by the Utah Department of Environmental Quality Division of Waste Management and Radiation Control (DWMRC) in their letter to Bountiful City dated March 12, 2012. The alternate GWPSs were developed in accordance with UAC R315-308-2 to account for the presence of naturally occurring background levels of arsenic that are present in groundwater in the vicinity of the Landfill. In accordance with the Landfill's permit, a review of the alternate GWPSs is required every 5-years. The prior 5-year review was conducted in 2017 and included a review of the data collected from 2011-2016. This report presents a review of the data collected during the current 5-year review period (i.e., 2017-2021). The purpose of this review is to evaluate whether the alternate GWPSs for wells BSL-2 and BSL-3 should be updated or revised based on the current data.

SCOPE OF WORK

The scope of work for the 5-year review included the following general tasks:

- Evaluating and conducting statistical trend tests on the arsenic data from background wells BSL-1, BG-1 and BG-2 and compliance wells BSL-2 and BSL-3.
- Performing a comparison of the current groundwater data (2017-2021) from the two compliance wells (BSL-2 and BSL-3) with the intra-well background data for each of these wells used to develop the alternate GWPSs.

- Evaluating the data and updating the alternate GWPSs for BSL-2 and BSL3, if determined appropriate, based on the statistical evaluation and comparison of the data.

GROUNDWATER ARSENIC DATA SETS

Bountiful City provided updated quarterly monitoring results for arsenic in groundwater from 2017-2021. This data was analyzed along with data from previous sampling events from 2002-2016 to evaluate the potential necessity of updating alternate GWPSs. Blind field duplicates collected for analytical precision and non-detected arsenic values were excluded from the evaluation. This is consistent with the 2011 alternate GWPS evaluation and the 2011-2016 review, both approved by DWMRC.

EPA software ProUCL Version 5.1 (EPA 600/R-07/041, June 2016) was used for the statistical analysis of the data sets (time series data from 2002-2021, 2002-2010, and 2017-2021) evaluated in this report. Table 1 includes the input data set, Table 2 provides summary statistics, Table 3 provides trend testing results and Table 4 provides a summary of the Analysis of Variance (ANOVA) tests performed on the data. Appendix A contains the outputs of ProUCL for the data summarized in the above tables.

BACKGROUND WELL DATA EVALUATION

Background wells BSL-1, BG-1, and BG-2 were used to establish baseline groundwater arsenic levels. Data from June 2002 to December 2021 was used for BSL-1, while BG-1 and BG-2 include data from September 2010 through December 2021.

Recent data for BG-1 (2017-2021) shows normal or lognormal distribution of data; however, the 2010-2021 period shows no discernable distribution. All analysis time periods for BG-2 and BSL-1 result in normal or lognormal distribution (Table 2).

Background well trends over time are plotted in Figure 1 with Mann-Kendall and Thiel-Sen tests for trend analysis detailed in Table 3. BG-1 shows no significant trends for either test between 2010-2021 or 2017-2021. Well BG-2 has a decreasing trend for both tests during the 2010-2021 period, but no significant trend in the recent 2017-2021 time period. BSL-1 has an increasing trend overall (2002-2021) but has no significant trend from 2017-2021. Ordinary Least Squares (OLS) linear regression was performed on the time-series data for each well where a trend was present. Well BSL-1 had roughly equivalent correlation coefficients (r^2) values of 0.58 (2002-2010) and 0.55 (2002-2021) during increasing trend periods with minimal slopes of 0.0002 (mg/L/yr) and 0.0001 (mg/L/yr), respectively.

ANOVA tests were performed to compare arsenic data from the BSL-1 well during two time periods; 2002-2010, before alternate GWPSs were established and 2017-2021, the period for this review. Table 4 shows the parametric ("classic") and nonparametric ANOVA test results. Well BSL-1 exhibits statistically significant difference for both the classic and nonparametric ANOVA tests between the time periods, yet this can be explained by the change in trend from slightly increasing to no significant trend during the background monitoring period and recent sampling events respectively.

Using the compiled statistical analysis of the background well data, there does not appear to be a significant increase in background arsenic concentrations based on the following findings:

- BG-1 shows no significant trends for any time period analyzed;
- BG-2 shows an overall (2002-2021) decreasing trend with no significant trend in the recent (2017-2021) period; and
- BSL-1 shows no significant trend for the recent (2017-2021) period and an overall (2002-2017) negligible increase in arsenic concentration.

The results of this analysis agree with the previous 5-year review, which also did not show a significant change in background concentrations.

COMPLIANCE WELL DATA EVALUATION

Compliance wells BSL-2 and BSL-3 were evaluated using data from three time periods: 2002-2010, 2017-2021, and 2002-2021. The purpose of the selected time periods is to measure recent data trends for the current evaluation period (2017-2021) against established background trends (2002-2010) used to develop alternate GWPSs, and the overall sampling history (2002-2021). Statistics for these compliance wells are summarized in Table 2. BSL-2 and BSL-3 exhibit normal or lognormal distribution in all time periods except for 2002-2021 for BSL-2, which shows only lognormal data distribution. During the alternate GWPSs development, lognormal distributions were used for BSL-2 and normal distributions were used for BSL-3 (both at a 0.05 significance level). To be consistent with the current data, alternate GWPSs development, and 2011-2016 review, Geosyntec used the same distributions during this evaluation.

Mean arsenic concentrations at BSL-2 decreased from 0.019 (mg/L) during 2002-2010 to 0.013 (mg/L) from 2017-2021. Mean values at BSL-3 have slightly increased during these same time periods from 0.054 (mg/L) to 0.060 (mg/L). However, the increase is not statistically significant in the ANOVA tests (Table 4), as both the classic and nonparametric tests result in P-values greater than 0.05, meaning the mean and median of the datasets are comparable.

Table 3 contains the trend test results for BSL-2 and BSL-3. While initial trends for BSL-2 were slightly increasing, recent trends (2017-2021) show no significant trends and the entire dataset (2002-2021) also shows no significant trends. BSL-3 shows slightly increasing trends for the entire data set (2002-2017), while exhibiting no significant trends in the recent time frame (2017-2021). The r^2 value for BSL-2 during the initial increasing trend (2002-2010) is average at 0.4 with an increase of 0.0005 mg/L per year. The r^2 value for BSL-3 for the overall time interval (2002-2021) is low (0.09) with a minor increase of 0.0002 mg/L per year.

RECOMMENDATIONS

Geosyntec's analysis of recent and historic arsenic concentrations in groundwater at the Landfill supports the current alternate GWSPs and indicates that no updates are needed at this time. This is supported by statistical analysis of the background wells showing no significant-to-minimally increasing trends in groundwater arsenic concentrations at wells BG-1, BG-2, and BSL-1 and enough data at each compliance well to be considered statistically significant (over 50 observations at each).

The RCRA Unified Guidance states (without firm rules) that frequency or timing of updates to background may be performed:

- To enlarge initially small well-specific background observation data sets;
- To ensure that more recent compliance measurements are not impacted by a potential release;
- When sufficient new data have been collected to allow a statistical comparison with existing background data at compliance wells;
- When there is no significant difference between new data and existing background data; and/or
- When there is no statistically significant increase in concentrations at a compliance well.

Based on the results of the first 5-year review period (2011-2016) and the consistent results from this 5-year period (2017-2021), there is no evidence to support updating the GWPSs. Table 5 shows the results of combining all compliance data (2002-2021) relative to the existing background period (2002-2010). The 95/95 upper tolerance limits (UTLs) show little change for BSL-2 (0.046 to 0.040) and BSL-3 (0.082 to 0.080).

Table 5 Comparison of UTLs Calculated Using Existing (2002-2010) versus Updated (2002-2021) Monitoring Results.

Well	Existing Background Data Set (2002-2010)		Updated Background Data Set (2002-2021)	
	Observations	95/95 UTL	Observations	95/95 UTL
BSL-2	32	0.046	76	0.040
BSL-3	33	0.082	77	0.080

Based on this analysis, Geosyntec recommends maintaining the 5-year review frequency for groundwater arsenic data. The next review should remain consistent with evaluation of site date and an update/revision of the GWPS only if results of the analysis indicate a necessity.

CLOSING

Geosyntec appreciates the opportunity to provide this 5-year review for Bountiful City. If you have any questions, please feel free to contact us at 801-618-0483.

Sincerely,

BC Robinson

Brent C. Robinson, P.E.
Senior Principal

Brian Smith, P.G.
Project Manager

Attachments:

Figure 1 – Arsenic Time Series for Background Wells
Figure 2 – Arsenic Time Series for Compliance Wells

Table 1 – Groundwater Arsenic Data Sets
Table 2 – Summary Statistics and Distribution Fitting Results
Table 3 – Trend Testing Results
Table 4 – ANOVA Test Results

Appendix A – ProUCL Outputs

FIGURES

Figure 1
Arsenic Time Series for
Background Wells
Bountiful Landfill

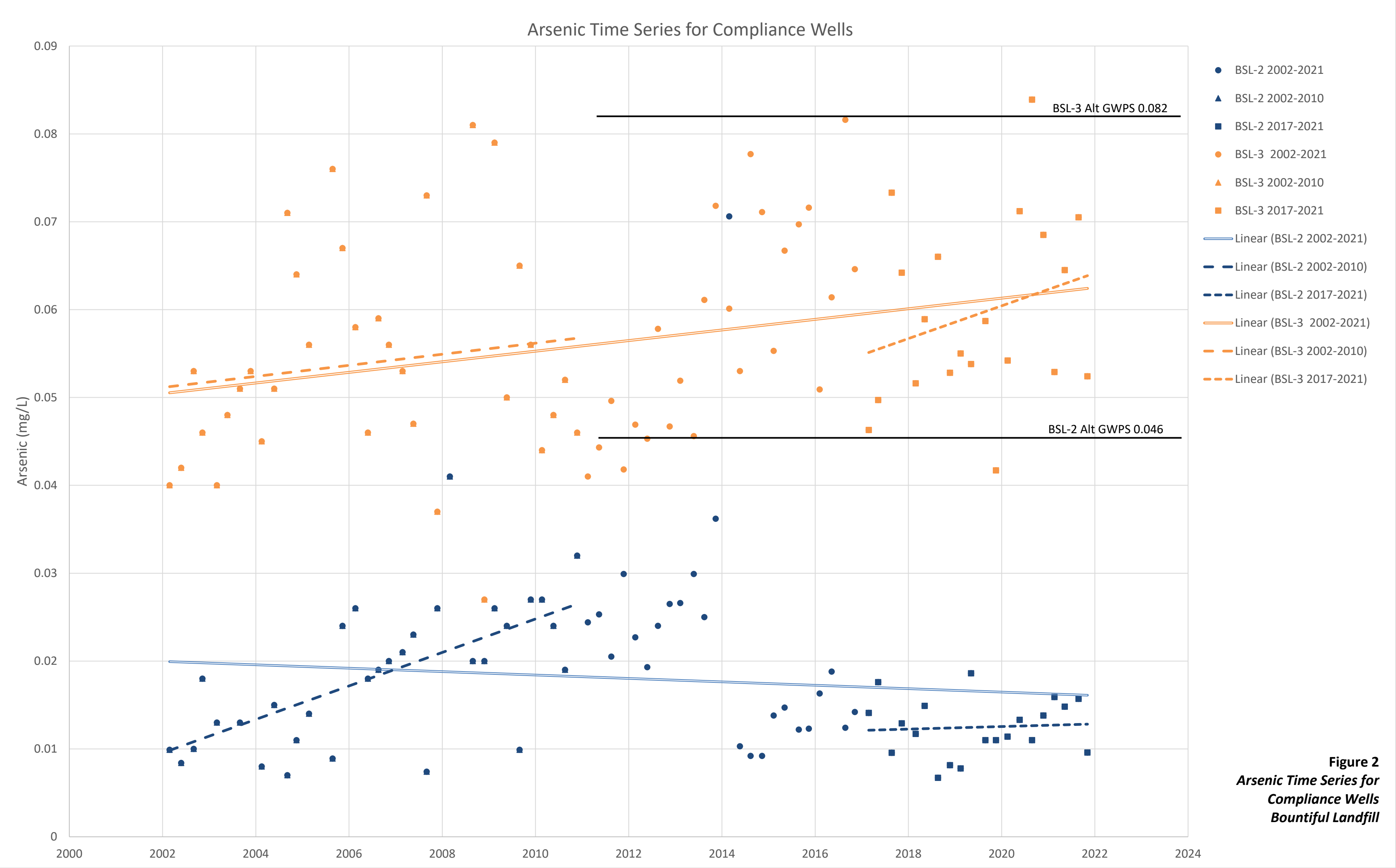


Figure 2
Arsenic Time Series for
Compliance Wells
Bountiful Landfill

TABLES

Table 1
Groundwater Arsenic Data Set
Bountiful Landfill

Well	Date Sampled	Arsenic (mg/L)
BG-1	9/16/2010	0.026
BG-1	12/20/2010	0.023
BG-1	3/20/2012	0.0223
BG-1	9/13/2012	0.0388
BG-1	3/7/2013	0.0214
BG-1	9/12/2013	0.041
BG-1	3/26/2014	0.0246
BG-1	9/9/2014	0.049
BG-1	3/9/2015	0.0238
BG-1	9/22/2015	0.0454
BG-1	3/3/2016	0.025
BG-1	9/21/2016	0.0417
BG-1	3/24/2017	0.0231
BG-1	9/20/2017	0.0418
BG-1	3/26/2018	0.0236
BG-1	9/19/2018	0.0369
BG-1	3/14/2019	0.0246
BG-1	9/25/2019	0.0394
BG-1	3/17/2020	0.0286
BG-1	9/23/2020	0.0437
BG-1	3/19/2021	0.0235
BG-1	9/24/2021	0.0476
BG-2	9/16/2010	0.033
BG-2	12/20/2010	0.025
BG-2	3/20/2012	0.0128
BG-2	9/13/2012	0.0245
BG-2	3/7/2013	0.0138
BG-2	9/12/2013	0.0226
BG-2	3/26/2014	0.02
BG-2	9/10/2014	0.0284
BG-2	3/10/2015	0.0187
BG-2	9/23/2015	0.0213
BG-2	3/4/2016	0.00993

Table 1
Groundwater Arsenic Data Set
Bountiful Landfill

Well	Date Sampled	Arsenic (mg/L)
BG-2	9/21/2016	0.0161
BG-2	3/24/2017	0.00688
BG-2	9/20/2017	0.0164
BG-2	3/27/2018	0.0111
BG-2	9/18/2018	0.014
BG-2	3/15/2019	0.00767
BG-2	9/24/2019	0.0114
BG-2	3/16/2020	0.00719
BG-2	9/23/2020	0.0139
BG-2	3/19/2021	0.00872
BG-2	9/23/2021	0.0206
BSL-1	3/21/2002	0.0057
BSL-1	9/26/2002	0.0054
BSL-1	3/12/2004	0.006
BSL-1	9/30/2004	0.006
BSL-1	9/19/2005	0.0073
BSL-1	3/17/2006	0.0076
BSL-1	9/14/2006	0.0059
BSL-1	9/27/2007	0.0064
BSL-1	9/24/2009	0.0069
BSL-1	3/19/2010	0.0077
BSL-1	9/16/2010	0.0081
BSL-1	3/14/2011	0.00716
BSL-1	9/14/2011	0.00671
BSL-1	3/20/2012	0.00768
BSL-1	9/13/2012	0.00947
BSL-1	3/7/2013	0.00945
BSL-1	9/12/2013	0.00861
BSL-1	3/26/2014	0.00697
BSL-1	9/9/2014	0.0082
BSL-1	3/9/2015	0.00688
BSL-1	9/22/2015	0.00799
BSL-1	3/3/2016	0.00823

Table 1
Groundwater Arsenic Data Set
Bountiful Landfill

Well	Date Sampled	Arsenic (mg/L)
BSL-1	9/22/2016	0.00784
BSL-1	3/23/2017	0.00844
BSL-1	9/21/2017	0.00808
BSL-1	3/26/2018	0.0101
BSL-1	9/19/2018	0.0072
BSL-1	3/14/2019	0.012
BSL-1	9/24/2019	0.00981
BSL-1	3/17/2020	0.0104
BSL-1	9/23/2020	0.00912
BSL-1	3/18/2021	0.00917
BSL-1	9/23/2021	0.00837
BSL-2	3/21/2002	0.0099
BSL-2	6/20/2002	0.0084
BSL-2	9/26/2002	0.01
BSL-2	12/4/2002	0.018
BSL-2	3/27/2003	0.013
BSL-2	9/24/2003	0.013
BSL-2	3/12/2004	0.008
BSL-2	6/18/2004	0.015
BSL-2	9/30/2004	0.007
BSL-2	12/10/2004	0.011
BSL-2	3/18/2005	0.014
BSL-2	9/19/2005	0.0089
BSL-2	12/6/2005	0.024
BSL-2	3/17/2006	0.026
BSL-2	6/23/2006	0.018
BSL-2	9/14/2006	0.019
BSL-2	12/5/2006	0.02
BSL-2	3/22/2007	0.021
BSL-2	6/15/2007	0.023
BSL-2	9/27/2007	0.0074
BSL-2	12/20/2007	0.026
BSL-2	3/27/2008	0.041

Table 1
Groundwater Arsenic Data Set
Bountiful Landfill

Well	Date Sampled	Arsenic (mg/L)
BSL-2	9/23/2008	0.02
BSL-2	12/22/2008	0.02
BSL-2	3/12/2009	0.026
BSL-2	6/16/2009	0.024
BSL-2	9/24/2009	0.0099
BSL-2	12/21/2009	0.027
BSL-2	3/19/2010	0.027
BSL-2	6/17/2010	0.024
BSL-2	9/16/2010	0.019
BSL-2	12/20/2010	0.032
BSL-2	3/14/2011	0.0244
BSL-2	6/10/2011	0.0253
BSL-2	9/14/2011	0.0205
BSL-2	12/20/2011	0.0299
BSL-2	3/20/2012	0.0227
BSL-2	6/22/2012	0.0193
BSL-2	9/13/2012	0.024
BSL-2	12/14/2012	0.0265
BSL-2	3/7/2013	0.0266
BSL-2	6/21/2013	0.0299
BSL-2	9/12/2013	0.025
BSL-2	12/10/2013	0.0362
BSL-2	3/26/2014	0.0706
BSL-2	6/18/2014	0.0103
BSL-2	9/10/2014	0.0092
BSL-2	12/9/2014	0.0092
BSL-2	3/10/2015	0.0138
BSL-2	6/3/2015	0.0147
BSL-2	9/23/2015	0.0122
BSL-2	12/10/2015	0.0123
BSL-2	3/4/2016	0.0163
BSL-2	6/6/2016	0.0188
BSL-2	9/21/2016	0.0124

Table 1
Groundwater Arsenic Data Set
Bountiful Landfill

Well	Date Sampled	Arsenic (mg/L)
BSL-2	12/5/2016	0.0142
BSL-2	3/24/2017	0.0141
BSL-2	6/6/2017	0.0176
BSL-2	9/20/2017	0.00956
BSL-2	12/8/2017	0.0129
BSL-2	3/27/2018	0.0117
BSL-2	6/6/2018	0.0149
BSL-2	9/18/2018	0.00671
BSL-2	12/21/2018	0.00814
BSL-2	3/15/2019	0.00778
BSL-2	6/4/2019	0.0186
BSL-2	9/25/2019	0.011
BSL-2	12/17/2019	0.011
BSL-2	3/16/2020	0.0114
BSL-2	6/19/2020	0.0133
BSL-2	9/24/2020	0.011
BSL-2	12/22/2020	0.0138
BSL-2	3/19/2021	0.0159
BSL-2	6/8/2021	0.0148
BSL-2	9/24/2021	0.0157
BSL-2	12/3/2021	0.00959
BSL-3	3/21/2002	0.04
BSL-3	6/20/2002	0.042
BSL-3	9/26/2002	0.053
BSL-3	12/4/2002	0.046
BSL-3	3/27/2003	0.04
BSL-3	6/18/2003	0.048
BSL-3	9/24/2003	0.051
BSL-3	12/17/2003	0.053
BSL-3	3/12/2004	0.045
BSL-3	6/18/2004	0.051
BSL-3	9/30/2004	0.071
BSL-3	12/10/2004	0.064

Table 1
Groundwater Arsenic Data Set
Bountiful Landfill

Well	Date Sampled	Arsenic (mg/L)
BSL-3	3/18/2005	0.056
BSL-3	9/19/2005	0.076
BSL-3	12/6/2005	0.067
BSL-3	3/17/2006	0.058
BSL-3	6/23/2006	0.046
BSL-3	9/14/2006	0.059
BSL-3	12/5/2006	0.056
BSL-3	3/22/2007	0.053
BSL-3	6/15/2007	0.047
BSL-3	9/27/2007	0.073
BSL-3	12/20/2007	0.037
BSL-3	9/23/2008	0.081
BSL-3	12/22/2008	0.027
BSL-3	3/12/2009	0.079
BSL-3	6/16/2009	0.05
BSL-3	9/24/2009	0.065
BSL-3	12/21/2009	0.056
BSL-3	3/19/2010	0.044
BSL-3	6/17/2010	0.048
BSL-3	9/16/2010	0.052
BSL-3	12/20/2010	0.046
BSL-3	3/14/2011	0.041
BSL-3	6/10/2011	0.0443
BSL-3	9/14/2011	0.0496
BSL-3	12/20/2011	0.0418
BSL-3	3/20/2012	0.0469
BSL-3	6/22/2012	0.0453
BSL-3	9/13/2012	0.0578
BSL-3	12/14/2012	0.0467
BSL-3	3/7/2013	0.0519
BSL-3	6/21/2013	0.0456
BSL-3	9/12/2013	0.0611
BSL-3	12/10/2013	0.0718

Table 1
Groundwater Arsenic Data Set
Bountiful Landfill

Well	Date Sampled	Arsenic (mg/L)
BSL-3	3/26/2014	0.0601
BSL-3	6/18/2014	0.053
BSL-3	9/10/2014	0.0777
BSL-3	12/9/2014	0.0711
BSL-3	3/10/2015	0.0553
BSL-3	6/3/2015	0.0667
BSL-3	9/23/2015	0.0697
BSL-3	12/10/2015	0.0716
BSL-3	3/4/2016	0.0509
BSL-3	6/6/2016	0.0614
BSL-3	9/21/2016	0.0816
BSL-3	12/5/2016	0.0646
BSL-3	3/24/2017	0.0463
BSL-3	6/6/2017	0.0497
BSL-3	9/20/2017	0.0733
BSL-3	12/8/2017	0.0642
BSL-3	3/27/2018	0.0516
BSL-3	6/6/2018	0.0589
BSL-3	9/18/2018	0.066
BSL-3	12/21/2018	0.0528
BSL-3	3/15/2019	0.055
BSL-3	6/4/2019	0.0538
BSL-3	9/25/2019	0.0587
BSL-3	12/17/2019	0.0417
BSL-3	3/17/2020	0.0542
BSL-3	6/19/2020	0.0712
BSL-3	9/24/2020	0.0839
BSL-3	12/22/2020	0.0685
BSL-3	3/19/2021	0.0529
BSL-3	6/8/2021	0.0645
BSL-3	9/24/2021	0.0705
BSL-3	12/3/2021	0.0524

Table 2

Summary Statistics and Distribution Fitting Results

Bountiful Landfill

Well	Date Range	Number of Results	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Geometric Mean	Standard Deviation	Coefficient of Variation	Distribution
BG-1	2017-2021	10	0.023	0.048	0.033	0.032	0.010	0.288	N or LN
	2010-2021	22	0.021	0.049	0.033	0.031	0.010	0.302	NDD
BG-2	2017-2021	10	0.007	0.021	0.012	0.011	0.004	0.380	N or LN
	2010-2021	22	0.007	0.033	0.017	0.015	0.007	0.436	N or LN
BSL-1	2002-2010	11	0.005	0.008	0.007	0.007	0.001	0.139	N or LN
	2017-2021	10	0.007	0.012	0.009	0.009	0.001	0.148	N or LN
	2002-2021	33	0.005	0.012	0.008	0.008	0.001	0.189	N or LN
BSL-2	2002-2010	32	0.007	0.041	0.019	0.017	0.008	0.441	N or LN
	2017-2021	20	0.007	0.019	0.013	0.012	0.003	0.261	N or LN
	2002-2021	76	0.007	0.071	0.018	0.016	0.010	0.537	LN
BSL-3	2002-2010	33	0.027	0.081	0.054	0.053	0.013	0.232	N or LN
	2017-2021	20	0.042	0.084	0.060	0.059	0.011	0.176	N or LN
	2002-2021	77	0.027	0.084	0.057	0.055	0.012	0.211	N or LN

Notes:

Distribution (tested at 0.05 significance level)

LN= Lognormal

N = Normal

NDD = No Discernable Distribution

Table 3
Trend Testing Results
Bountiful Landfill

Well Type	Well ID	2002 - 2010 Data					2017 - 2021 Data					All Data 2002 - 2021				
		Number of Results	Trend Test		Linear Regression		Number of Results	Trend Test		Linear Regression		Number of Results	Trend Test		Linear Regression	
			Mann-Kendall	Thiel-Sien	r^2	Slope (mg/L/yr)		Mann-Kendall	Thiel-Sien	r^2	Slope (mg/L/yr)		Mann-Kendall	Thiel-Sien	r^2	Slope (mg/L/yr)
Background	BG-1	No data					10	No trend	No trend	0.12	0.0011	22	No trend	No trend	0.07	0.0004
	BG-2	No data					10	No trend	No trend	0.08	0.0004	22	Decreasing (P 0.0024)	Decreasing	0.39	-0.0007
	BSL-1	11	Increasing (P 0.003)	Increasing	0.58	0.0002	10	No trend	No trend	0.02	0.0001	33	Increasing (P 0.000002)	Increasing	0.55	0.0001
Compliance	BSL-2	32	Increasing (P 0.00004)	Increasing	0.40	0.0005	20	No Trend	No Trend	0.01	0.0000	76	No trend	No trend	0.02	-0.0001
	BSL-3	33	No trend	No Trend	0.02	0.0002	20	No Trend	No Trend	0.07	0.0005	77	Increasing (P 0.003)	Increasing	0.09	0.0002

Table 4
ANOVA Test Results
Bountiful Landfill

Well	Groups		Classical ANOVA							Nonparametric ANOVA		
	Data Range	Number of Obs.	Source	Sum of Squares (SS)	Degrees of Freedom (DOF)	Mean Square (MS)	F Statistic	P-Value	Test Result	Kruskal-Wallis H Statistic	P-Value	Test Result
BSL-1	2002 - 2010	11	Between Groups	3.63E-05	1	3.63E-05	27.1	0.00005	Statistically Significant Difference	12.4	0.0004	Statistically Significant Difference
	2017 - 2021	10	Within Groups	2.55E-05	19	1.34E-06						
	Total	21	Total	6.18E-05	20	--						
BSL-2	2002 - 2010	32	Between Groups	4.40E-04	1	4.40E-04	9.7	0.003	Statistically Significant Difference	6.99	0.008	Statistically Significant Difference
	2017 - 2021	20	Within Groups	0.00226	50	4.52E-05						
	Total	52	Total	0.0027	51	--						
BSL-3	2002 - 2010	33	Between Groups	3.86E-04	1	3.86E-04	2.77	0.10	No Difference	3.30	0.069	No Difference
	2017 - 2021	20	Within Groups	0.0071	51	1.39E-04						
	Total	53	Total	0.00749	52	--						

Notes:

A P-value <= 0.05 suggests that there are significant differences in mean/median characteristics of the various groups at a 0.05 level of significance

A P-value > 0.05 suggests that mean/median characteristics of the various groups are comparable.

APPENDIX A

ProUCL Outputs

```
                         Goodness-of-Fit Test Statistics for Uncensored Full Data Sets without Non-Detects
           User Selected Options
     Date/Time of Computation  ProUCL 5.12/10/2022 1:06:42 PM
                    From File  qryJDW_ProUCL_Input_D3_20220210.xls
               Full Precision  OFF
       Confidence Coefficient  0.95


Result (background;bg-1;arsenic;mg/l)

                        Raw Statistics
               Number of Valid Observations   22
            Number of Distinct Observations   21
                                    Minimum   0.0214
                                    Maximum   0.049
                           Mean of Raw Data   0.0325
             Standard Deviation of Raw Data  0.00981
                                       Khat   11.75
                                  Theta hat  0.00276
                                      Kstar   10.18
                                 Theta star  0.00319
             Mean of Log Transformed Data   -3.47
  Standard Deviation of Log Transformed Data   0.299

                    Normal GOF Test Results

                   Correlation Coefficient R   0.927
                 Shapiro Wilk Test Statistic   0.842
            Shapiro Wilk Critical (0.05) Value   0.911
            Approximate Shapiro Wilk P Value  0.00182
                   Lilliefors Test Statistic   0.246
              Lilliefors Critical (0.05) Value   0.184
Data not Normal at (0.05) Significance Level

                    Gamma GOF Test Results

                   Correlation Coefficient R   0.936
                           A-D Test Statistic   1.576
                      A-D Critical (0.05) Value   0.743
                           K-S Test Statistic   0.238
                       K-S Critical(0.05)  Value   0.185
Data not Gamma Distributed at (0.05) Significance Level

                  Lognormal GOF Test Results

                   Correlation Coefficient R   0.929
                 Shapiro Wilk Test Statistic   0.845
            Shapiro Wilk Critical (0.05) Value   0.911
            Approximate Shapiro Wilk P Value  0.00208
                   Lilliefors Test Statistic   0.226
              Lilliefors Critical (0.05) Value   0.184
```

Data not Lognormal at (0.05) Significance Level

Non-parametric GOF Test Results

Data do not follow a discernible distribution at (0.05) Level of Significanc

Result (background;bg-2;arsenic;mg/l)

Raw Statistics

Number of Valid Observations	22
Number of Distinct Observations	22
Minimum	0.00688
Maximum	0.033
Mean of Raw Data	0.0165
Standard Deviation of Raw Data	0.00722
Khat	5.435
Theta hat	0.00304
Kstar	4.724
Theta star	0.0035
Mean of Log Transformed Data	-4.196
Standard Deviation of Log Transformed Data	0.454

Normal GOF Test Results

Correlation Coefficient R	0.981
Shapiro Wilk Test Statistic	0.954
Shapiro Wilk Critical (0.05) Value	0.911
Approximate Shapiro Wilk P Value	0.382
Lilliefors Test Statistic	0.138
Lilliefors Critical (0.05) Value	0.184

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.994
A-D Test Statistic	0.201
A-D Critical (0.05) Value	0.746
K-S Test Statistic	0.0923
K-S Critical(0.05) Value	0.186

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.99
Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical (0.05) Value	0.911
Approximate Shapiro Wilk P Value	0.673
Lilliefors Test Statistic	0.0979
Lilliefors Critical (0.05) Value	0.184

Data appear Lognormal at (0.05) Significance Level

```
Result (background;bsl-1;arsenic;mg/l)

                         Raw Statistics
                 Number of Valid Observations    33
              Number of Distinct Observations    32
                                      Minimum   0.0054
                                      Maximum    0.012
                             Mean of Raw Data   0.00791
               Standard Deviation of Raw Data   0.00149
                                         Khat    29.66
                                    Theta hat 2.6654E-4
                                        Kstar    26.98
                                   Theta star 2.9297E-4
               Mean of Log Transformed Data    -4.857
 Standard Deviation of Log Transformed Data     0.187

                     Normal GOF Test Results

                    Correlation Coefficient R    0.986
                  Shapiro Wilk Test Statistic    0.973
             Shapiro Wilk Critical (0.05) Value  0.931
           Approximate Shapiro Wilk P Value      0.62
                   Lilliefors Test Statistic    0.0874
              Lilliefors Critical (0.05) Value   0.152
Data appear Normal at (0.05) Significance Level

                     Gamma GOF Test Results

                    Correlation Coefficient R    0.994
                            A-D Test Statistic   0.148
                      A-D Critical (0.05) Value  0.745
                            K-S Test Statistic  0.0667
                      K-S Critical(0.05)  Value  0.153
Data appear Gamma Distributed at (0.05) Significance Level

                    Lognormal GOF Test Results

                    Correlation Coefficient R    0.995
                  Shapiro Wilk Test Statistic    0.987
             Shapiro Wilk Critical (0.05) Value  0.931
           Approximate Shapiro Wilk P Value      0.961
                   Lilliefors Test Statistic    0.0687
              Lilliefors Critical (0.05) Value   0.152
Data appear Lognormal at (0.05) Significance Level

Result (compliance;bsl-2;arsenic;mg/l)

                         Raw Statistics
                 Number of Valid Observations    76
              Number of Distinct Observations    58
                                      Minimum   0.00671
```

Maximum	0.0706
Mean of Raw Data	0.018
Standard Deviation of Raw Data	0.00964
Khat	4.607
Theta hat	0.0039
Kstar	4.433
Theta star	0.00405
Mean of Log Transformed Data	-4.133
Standard Deviation of Log Transformed Data	0.466

Normal GOF Test Results

Correlation Coefficient R	0.893
Approximate Shapiro Wilk Test Statistic	0.824
Approximate Shapiro Wilk P Value	1.563E-12
Lilliefors Test Statistic	0.122
Lilliefors Critical (0.05) Value	0.102

Data not Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.951
A-D Test Statistic	0.637
A-D Critical (0.05) Value	0.755
K-S Test Statistic	0.0855
K-S Critical(0.05) Value	0.103

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.989
Approximate Shapiro Wilk Test Statistic	0.973
Approximate Shapiro Wilk P Value	0.321
Lilliefors Test Statistic	0.0696
Lilliefors Critical (0.05) Value	0.102

Data appear Lognormal at (0.05) Significance Level

Result (compliance;bsl-3;arsenic;mg/l)

Raw Statistics

Number of Valid Observations	77
Number of Distinct Observations	67
Minimum	0.027
Maximum	0.0839
Mean of Raw Data	0.0566
Standard Deviation of Raw Data	0.0119
Khat	22.65
Theta hat	0.0025
Kstar	21.78
Theta star	0.0026
Mean of Log Transformed Data	-2.894

Standard Deviation of Log Transformed Data	0.214

Normal GOF Test Results

Correlation Coefficient R	0.987
Approximate Shapiro Wilk Test Statistic	0.966
Approximate Shapiro Wilk P Value	0.124
Lilliefors Test Statistic	0.112
Lilliefors Critical (0.05) Value	0.101

Data appear Approximate Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.99
A-D Test Statistic	0.507
A-D Critical (0.05) Value	0.75
K-S Test Statistic	0.0877
K-S Critical(0.05) Value	0.101

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.987
Approximate Shapiro Wilk Test Statistic	0.974
Approximate Shapiro Wilk P Value	0.358
Lilliefors Test Statistic	0.0737
Lilliefors Critical (0.05) Value	0.101

Data appear Lognormal at (0.05) Significance Level

```
                          Background Statistics for Uncensored Full Data Sets
            User Selected Options
       Date/Time of Computation   ProUCL 5.12/10/2022 1:07:55 PM
                      From File   P:\GIS\SLC1044 - Bountiful Landfill\Database\Export\20220210\D3 2002-2021\qryJDW_ProUCL_Input_D3_202
                 Full Precision   OFF
         Confidence Coefficient   95%
                       Coverage   95%
     New or Future K Observations   1
   Number of Bootstrap Operations   2000

Result (background;bg-1;arsenic;mg/l)

General Statistics
             Total Number of Observations   22                  Number of Distinct Observations   21
                                  Minimum   0.0214                               First Quartile   0.0237
                           Second Largest   0.0476                                       Median   0.0273
                                  Maximum   0.049                                Third Quartile   0.0415
                                     Mean   0.0325                                           SD   0.00981
                 Coefficient of Variation   0.302                                      Skewness   0.358
                        Mean of logged Data  -3.47                               SD of logged Data   0.299

                          Critical Values for Background Threshold Values (BTVs)
               Tolerance Factor K (For UTL)   2.349                               d2max (for USL)   2.603

                                          Normal GOF Test
               Shapiro Wilk Test Statistic   0.842                 Shapiro Wilk GOF Test
             5% Shapiro Wilk Critical Value   0.911          Data Not Normal at 5% Significance Level
                  Lilliefors Test Statistic   0.246                   Lilliefors GOF Test
               5% Lilliefors Critical Value   0.184          Data Not Normal at 5% Significance Level
                              Data Not Normal at 5% Significance Level

                              Background Statistics Assuming Normal Distribution
              95% UTL with  95% Coverage   0.0555                              90% Percentile (z)   0.0451
                                95% UPL (t)   0.0498                              95% Percentile (z)   0.0486
                                  95% USL   0.058                               99% Percentile (z)   0.0553

                                          Gamma GOF Test
                         A-D Test Statistic   1.576           Anderson-Darling Gamma GOF Test
                        5% A-D Critical Value   0.743      Data Not Gamma Distributed at 5% Significance Level
                         K-S Test Statistic   0.238         Kolmogorov-Smirnov Gamma GOF Test
                        5% K-S Critical Value   0.185      Data Not Gamma Distributed at 5% Significance Level
                            Data Not Gamma Distributed at 5% Significance Level

                                          Gamma Statistics
                                k hat (MLE)   11.75                  k star (bias corrected MLE)   10.18
                            Theta hat (MLE)   0.00276            Theta star (bias corrected MLE)   0.00319
                               nu hat (MLE)   517.2                    nu star (bias corrected)   448
                    MLE Mean (bias corrected)   0.0325                    MLE Sd (bias corrected)   0.0102

                              Background Statistics Assuming Gamma Distribution
      95% Wilson Hilferty (WH) Approx. Gamma UPL   0.0515                               90% Percentile   0.046
```

95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0518	95% Percentile	0.0508
95% WH Approx. Gamma UTL with 95% Coverage	0.0597	99% Percentile	0.0607
95% HW Approx. Gamma UTL with 95% Coverage	0.0604		
95% WH USL	0.0634	95% HW USL	0.0644

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.911	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.226	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.184	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.0629	90% Percentile (z)	0.0457
95% UPL (t)	0.0527	95% Percentile (z)	0.0509
95% USL	0.0678	99% Percentile (z)	0.0625

Nonparametric Distribution Free Background Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	22	95% UTL with 95% Coverage	0.049
Approx, f used to compute achieved CC	1.158	Approximate Actual Confidence Coefficient achieved by UTL	0.676
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.049	95% BCA Bootstrap UTL with 95% Coverage	0.049
95% UPL	0.0488	90% Percentile	0.0452
90% Chebyshev UPL	0.0626	95% Percentile	0.0475
95% Chebyshev UPL	0.0762	99% Percentile	0.0487
95% USL	0.049		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (background;bg-2;arsenic;mg/l)

General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
Minimum	0.00688	First Quartile	0.0112
Second Largest	0.0284	Median	0.0151
Maximum	0.033	Third Quartile	0.0211
Mean	0.0165	SD	0.00722
Coefficient of Variation	0.436	Skewness	0.568
Mean of logged Data	-4.196	SD of logged Data	0.454

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.349	d2max (for USL)	2.603

Normal GOF Test

```
                  Shapiro Wilk Test Statistic    0.954                  Shapiro Wilk GOF Test
                5% Shapiro Wilk Critical Value    0.911         Data appear Normal at 5% Significance Level
                     Lilliefors Test Statistic    0.138                   Lilliefors GOF Test
                  5% Lilliefors Critical Value    0.184         Data appear Normal at 5% Significance Level
                               Data appear Normal at 5% Significance Level

                           Background Statistics Assuming Normal Distribution
                 95% UTL with   95% Coverage    0.0335                              90% Percentile (z)    0.0258
                                  95% UPL (t)    0.0292                              95% Percentile (z)    0.0284
                                    95% USL     0.0353                              99% Percentile (z)    0.0333

                                             Gamma GOF Test
                          A-D Test Statistic    0.201              Anderson-Darling Gamma GOF Test
                          5% A-D Critical Value    0.746    Detected data appear Gamma Distributed at 5% Significance Level
                          K-S Test Statistic    0.0923           Kolmogorov-Smirnov Gamma GOF Test
                          5% K-S Critical Value    0.186    Detected data appear Gamma Distributed at 5% Significance Level
                         Detected data appear Gamma Distributed at 5% Significance Level

                                            Gamma Statistics
                                  k hat (MLE)    5.435                    k star (bias corrected MLE)    4.724
                              Theta hat (MLE)    0.00304              Theta star (bias corrected MLE)    0.0035
                                 nu hat (MLE)    239.2                       nu star (bias corrected)    207.9
                      MLE Mean (bias corrected)    0.0165                      MLE Sd (bias corrected)    0.00761

                           Background Statistics Assuming Gamma Distribution
     95% Wilson Hilferty (WH) Approx. Gamma UPL    0.0313                                90% Percentile    0.0267
      95% Hawkins Wixley (HW) Approx. Gamma UPL    0.0318                                95% Percentile    0.0307
   95% WH Approx. Gamma UTL with   95% Coverage    0.0384                                99% Percentile    0.0392
   95% HW Approx. Gamma UTL with   95% Coverage    0.0394
                                  95% WH USL    0.0417                                    95% HW USL    0.0431

                                            Lognormal GOF Test
                  Shapiro Wilk Test Statistic    0.969              Shapiro Wilk Lognormal GOF Test
                5% Shapiro Wilk Critical Value    0.911         Data appear Lognormal at 5% Significance Level
                     Lilliefors Test Statistic    0.0979               Lilliefors Lognormal GOF Test
                  5% Lilliefors Critical Value    0.184         Data appear Lognormal at 5% Significance Level
                               Data appear Lognormal at 5% Significance Level

                          Background Statistics assuming Lognormal Distribution
                 95% UTL with   95% Coverage    0.0438                              90% Percentile (z)    0.0269
                                  95% UPL (t)    0.0335                              95% Percentile (z)    0.0318
                                     95% USL    0.0491                              99% Percentile (z)    0.0433

                              Nonparametric Distribution Free Background Statistics
                               Data appear Normal at 5% Significance Level

                         Nonparametric Upper Limits for Background Threshold Values
                           Order of Statistic, r    22                        95% UTL with   95% Coverage    0.033
           Approx, f used to compute achieved CC    1.158    Approximate Actual Confidence Coefficient achieved by UTL    0.676
                                                                 Approximate Sample Size needed to achieve specified CC    59
   95% Percentile Bootstrap UTL with   95% Coverage    0.033              95% BCA Bootstrap UTL with   95% Coverage    0.033
```

95% UPL	0.0323	90% Percentile	0.025
90% Chebyshev UPL	0.0387	95% Percentile	0.0282
95% Chebyshev UPL	0.0487	99% Percentile	0.032
95% USL	0.033		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (background;bsl-1;arsenic;mg/l)

General Statistics

Total Number of Observations	33	Number of Distinct Observations	32
Minimum	0.0054	First Quartile	0.0069
Second Largest	0.0104	Median	0.00784
Maximum	0.012	Third Quartile	0.00861
Mean	0.00791	SD	0.00149
Coefficient of Variation	0.189	Skewness	0.563
Mean of logged Data	-4.857	SD of logged Data	0.187

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.176	d2max (for USL)	2.787

Normal GOF Test

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.0874	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.0112	90% Percentile (z)	0.00982
95% UPL (t)	0.0105	95% Percentile (z)	0.0104
95% USL	0.0121	99% Percentile (z)	0.0114

Gamma GOF Test

A-D Test Statistic	0.148	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0667	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.153	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	29.66	k star (bias corrected MLE)	26.98
Theta hat (MLE)	2.6654E-4	Theta star (bias corrected MLE)	2.9297E-4
nu hat (MLE)	1958	nu star (bias corrected)	1781
MLE Mean (bias corrected)	0.00791	MLE Sd (bias corrected)	0.00152

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0106	90% Percentile	0.00991
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0106	95% Percentile	0.0106
95% WH Approx. Gamma UTL with 95% Coverage	0.0115	99% Percentile	0.0119
95% HW Approx. Gamma UTL with 95% Coverage	0.0115		
95% WH USL	0.0126	95% HW USL	0.0127

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.987	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0687	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.0117	90% Percentile (z)	0.00987
95% UPL (t)	0.0107	95% Percentile (z)	0.0106
95% USL	0.0131	99% Percentile (z)	0.012

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	33	95% UTL with 95% Coverage	0.012
Approx, f used to compute achieved CC	1.737	Approximate Actual Confidence Coefficient achieved by UTL	0.816
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.012	95% BCA Bootstrap UTL with 95% Coverage	0.012
95% UPL	0.0109	90% Percentile	0.00974
90% Chebyshev UPL	0.0125	95% Percentile	0.0102
95% Chebyshev UPL	0.0145	99% Percentile	0.0115
95% USL	0.012		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (compliance;bsl-2;arsenic;mg/l)

General Statistics

Total Number of Observations	76	Number of Distinct Observations	58
Minimum	0.00671	First Quartile	0.011
Second Largest	0.041	Median	0.0154
Maximum	0.0706	Third Quartile	0.024
Mean	0.018	SD	0.00964
Coefficient of Variation	0.537	Skewness	2.455
Mean of logged Data	-4.133	SD of logged Data	0.466

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.97	d2max (for USL)	3.114

```
                                   Normal GOF Test
          Shapiro Wilk Test Statistic   0.824                   Normal GOF Test
            5% Shapiro Wilk P Value  1.563E-12       Data Not Normal at 5% Significance Level
             Lilliefors Test Statistic   0.122                 Lilliefors GOF Test
           5% Lilliefors Critical Value   0.102       Data Not Normal at 5% Significance Level
                         Data Not Normal at 5% Significance Level

                    Background Statistics Assuming Normal Distribution
          95% UTL with   95% Coverage   0.0369                       90% Percentile (z)   0.0303
                           95% UPL (t)   0.0341                       95% Percentile (z)   0.0338
                              95% USL    0.048                        99% Percentile (z)   0.0404

                                   Gamma GOF Test
                     A-D Test Statistic   0.637            Anderson-Darling Gamma GOF Test
                   5% A-D Critical Value   0.755   Detected data appear Gamma Distributed at 5% Significance Level
                     K-S Test Statistic   0.0855          Kolmogorov-Smirnov Gamma GOF Test
                   5% K-S Critical Value   0.103   Detected data appear Gamma Distributed at 5% Significance Level
                 Detected data appear Gamma Distributed at 5% Significance Level

                                   Gamma Statistics
                          k hat (MLE)   4.607                k star (bias corrected MLE)    4.433
                      Theta hat (MLE)   0.0039           Theta star (bias corrected MLE)   0.00405
                          nu hat (MLE)  700.2                    nu star (bias corrected)   673.9
             MLE Mean (bias corrected)   0.018                     MLE Sd (bias corrected)   0.00853

                    Background Statistics Assuming Gamma Distribution
   95% Wilson Hilferty (WH) Approx. Gamma UPL   0.0339                      90% Percentile   0.0294
  95% Hawkins Wixley (HW) Approx. Gamma UPL   0.0341                      95% Percentile   0.0339
95% WH Approx. Gamma UTL with   95% Coverage   0.0379                      99% Percentile   0.0434
95% HW Approx. Gamma UTL with   95% Coverage   0.0383
                                  95% WH USL   0.056                           95% HW USL   0.0582

                                  Lognormal GOF Test
          Shapiro Wilk Test Statistic   0.973              Shapiro Wilk Lognormal GOF Test
            5% Shapiro Wilk P Value   0.321          Data appear Lognormal at 5% Significance Level
             Lilliefors Test Statistic   0.0696             Lilliefors Lognormal GOF Test
           5% Lilliefors Critical Value   0.102          Data appear Lognormal at 5% Significance Level
                       Data appear Lognormal at 5% Significance Level

                    Background Statistics assuming Lognormal Distribution
          95% UTL with   95% Coverage   0.0402                       90% Percentile (z)   0.0291
                           95% UPL (t)   0.035                        95% Percentile (z)   0.0345
                              95% USL   0.0684                        99% Percentile (z)   0.0474

                      Nonparametric Distribution Free Background Statistics
                        Data appear Gamma Distributed at 5% Significance Level

                     Nonparametric Upper Limits for Background Threshold Values
                   Order of Statistic, r   75                     95% UTL with   95% Coverage   0.041
     Approx, f used to compute achieved CC   1.974   Approximate Actual Confidence Coefficient achieved by UTL   0.899
                                                     Approximate Sample Size needed to achieve specified CC   93
```

95% Percentile Bootstrap UTL with 95% Coverage	0.041	95% BCA Bootstrap UTL with 95% Coverage	0.0374
95% UPL	0.0326	90% Percentile	0.0268
90% Chebyshev UPL	0.0471	95% Percentile	0.0304
95% Chebyshev UPL	0.0602	99% Percentile	0.0484
95% USL	0.0706		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (compliance;bsl-3;arsenic;mg/l)

General Statistics

Total Number of Observations	77	Number of Distinct Observations	67
Minimum	0.027	First Quartile	0.047
Second Largest	0.0816	Median	0.0538
Maximum	0.0839	Third Quartile	0.065
Mean	0.0566	SD	0.0119
Coefficient of Variation	0.211	Skewness	0.326
Mean of logged Data	-2.894	SD of logged Data	0.214

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.967	d2max (for USL)	3.118

Normal GOF Test

Shapiro Wilk Test Statistic	0.966	**Normal GOF Test**
5% Shapiro Wilk P Value	0.124	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.112	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.101	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.0801	90% Percentile (z)	0.0719
95% UPL (t)	0.0766	95% Percentile (z)	0.0762
95% USL	0.0938	99% Percentile (z)	0.0843

Gamma GOF Test

A-D Test Statistic	0.507	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0877	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.101	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	22.65	k star (bias corrected MLE)	21.78
Theta hat (MLE)	0.0025	Theta star (bias corrected MLE)	0.0026
nu hat (MLE)	3489	nu star (bias corrected)	3354
MLE Mean (bias corrected)	0.0566	MLE Sd (bias corrected)	0.0121

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0781	90% Percentile	0.0726
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0783	95% Percentile	0.0779
95% WH Approx. Gamma UTL with 95% Coverage	0.0825	99% Percentile	0.0886
95% HW Approx. Gamma UTL with 95% Coverage	0.0829		
95% WH USL	0.101	95% HW USL	0.103

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.358	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0737	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.101	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.0843	90% Percentile (z)	0.0728
95% UPL (t)	0.0792	95% Percentile (z)	0.0787
95% USL	0.108	99% Percentile (z)	0.0911

Nonparametric Distribution Free Background Statistics

Data appear Approximate Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	76	95% UTL with 95% Coverage	0.0816
Approx, f used to compute achieved CC	2	Approximate Actual Confidence Coefficient achieved by UTL	0.903
		Approximate Sample Size needed to achieve specified CC	93
95% Percentile Bootstrap UTL with 95% Coverage	0.0811	95% BCA Bootstrap UTL with 95% Coverage	0.0816
95% UPL	0.0792	90% Percentile	0.0723
90% Chebyshev UPL	0.0926	95% Percentile	0.078
95% Chebyshev UPL	0.109	99% Percentile	0.0822
95% USL	0.0839		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.12/10/2022 1:07:06 PM
From File	qryJDW_ProUCL_Input_D3_20220210.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Result-background;bg-1;arsenic;mg/l

General Statistics

Number of Events Reported (m)	22
Number of Missing Events	0
Number or Reported Events Used	22
Number Values Reported (n)	22
Minimum	0.0214
Maximum	0.049
Mean	0.0325
Geometric Mean	0.0311
Median	0.0273
Standard Deviation	0.00981
Coefficient of Variation	0.302

Mann-Kendall Test

M-K Test Value (S)	48
Tabulated p-value	0.089
Standard Deviation of S	35.45
Standardized Value of S	1.326
Approximate p-value	0.0924

Insufficient evidence to identify a significant trend at the specified level of significance.

Result-background;bg-2;arsenic;mg/l

General Statistics

Number of Events Reported (m)	22
Number of Missing Events	0
Number or Reported Events Used	22
Number Values Reported (n)	22
Minimum	0.00688
Maximum	0.033
Mean	0.0165
Geometric Mean	0.015
Median	0.0151
Standard Deviation	0.00722
Coefficient of Variation	0.436

Mann-Kendall Test

M-K Test Value (S)	-101
Tabulated p-value	0.002
Standard Deviation of S	35.46

Standardized Value of S	-2.82
Approximate p-value	0.0024

Statistically significant evidence of a decreasing trend at the specified level of significance.

Result-background;bsl-1;arsenic;mg/l

General Statistics

Number of Events Reported (m)	33
Number of Missing Events	0
Number or Reported Events Used	33
Number Values Reported (n)	33
Minimum	0.0054
Maximum	0.012
Mean	0.00791
Geometric Mean	0.00777
Median	0.00784
Standard Deviation	0.00149
Coefficient of Variation	0.189

Mann-Kendall Test

M-K Test Value (S)	301
Critical Value (0.05)	1.645
Standard Deviation of S	64.53
Standardized Value of S	4.649
Approximate p-value	1.6687E-6

Statistically significant evidence of an increasing trend at the specified level of significance.

Result-compliance;bsl-2;arsenic;mg/l

General Statistics

Number of Events Reported (m)	76
Number of Missing Events	0
Number or Reported Events Used	76
Number Values Reported (n)	76
Minimum	0.00671
Maximum	0.0706
Mean	0.018
Geometric Mean	0.016
Median	0.0154
Standard Deviation	0.00964
Coefficient of Variation	0.537

Mann-Kendall Test

M-K Test Value (S)	-260
Critical Value (0.05)	-1.645
Standard Deviation of S	222.9
Standardized Value of S	-1.162
Approximate p-value	0.123

Insufficient evidence to identify a significant trend at the specified level of significance.

Result-compliance;bsl-3;arsenic;mg/l

General Statistics

Number of Events Reported (m)	77
Number of Missing Events	0
Number or Reported Events Used	77
Number Values Reported (n)	77
Minimum	0.027
Maximum	0.0839
Mean	0.0566
Geometric Mean	0.0553
Median	0.0538
Standard Deviation	0.0119
Coefficient of Variation	0.211

Mann-Kendall Test

M-K Test Value (S)	623
Critical Value (0.05)	1.645
Standard Deviation of S	227.3
Standardized Value of S	2.736
Approximate p-value	0.00311

Statistically significant evidence of an increasing trend at the specified level of significance.

```
                     Theil-Sen Trend Test Analysis
      User Selected Options
 Date/Time of Computation   ProUCL 5.12/10/2022 1:07:30 PM
                From File   qryJDW_ProUCL_Input_D3_20220210.xls
           Full Precision   OFF
       Average Replicates   Replicates at sampling events will be averaged!
   Confidence Coefficient   0.95
    Level of Significance   0.05

      Result-background;bg-1;arsenic;mg/l


              General Statistics
                         Number of Events     22
              Number of Values Reported (n)   22
           Number of Values After Averaging   22
                     Number of Replicates      0
                                  Minimum    0.0214
                                  Maximum    0.049
                                     Mean    0.0325
                           Geometric Mean    0.0311
                                   Median    0.0273
                       Standard Deviation   0.00981
                 Coefficient of Variation     0.302

             Mann-Kendall Statistics
                        M-K Test Value (S)   48
                         Tabulated p-value   0.089
                     Standard Deviation of S 35.45
                    Standardized Value of S   1.326
                        Approximate p-value  0.0924

     Approximate inference for Theil-Sen Trend Test
                          Number of Slopes   231
                           Theil-Sen Slope 2.5000E-4
                       Theil-Sen Intercept   0.0244
                                        M1   80.76
                                        M2  150.2
                     95% LCL of Slope (0.025) -1.373E-4
                     95% UCL of Slope (0.975)  0.0011

  Insufficient evidence to identify a significant
   trend at the specified level of significance.

     Theil-Sen Trend Test Estimates and Residuals
        #  Events     Values     Estimates   Residuals
        1    1         0.026      0.0247      0.00133
        2    2         0.023      0.0249     -0.00193
        3    3         0.0223     0.0252     -0.00288
        4    4         0.0388     0.0254      0.0134
        5    5         0.0214     0.0257     -0.00428
        6    6         0.041      0.0259      0.0151
```

```
      7    7            0.0246      0.0262    -0.00158
      8    8            0.049       0.0264     0.0226
      9    9            0.0238      0.0267    -0.00288
     10   10            0.0454      0.0269     0.0185
     11   11            0.025       0.0272    -0.00218
     12   12            0.0417      0.0274     0.0143
     13   13            0.0231      0.0277    -0.00458
     14   14            0.0418      0.0279     0.0139
     15   15            0.0236      0.0282    -0.00458
     16   16            0.0369      0.0284     0.00848
     17   17            0.0246      0.0287    -0.00408
     18   18            0.0394      0.0289     0.0105
     19   19            0.0286      0.0292   -5.750E-4
     20   20            0.0437      0.0294     0.0143
     21   21            0.0235      0.0297    -0.00618
     22   22            0.0476      0.0299     0.0177
         Result-background;bg-2;arsenic;mg/l


                 General Statistics
                              Number of Events     22
                   Number of Values Reported (n)    22
                Number of Values After Averaging    22
                          Number of Replicates      0
                                        Minimum   0.00688
                                        Maximum    0.033
                                           Mean    0.0165
                                 Geometric Mean    0.015
                                         Median    0.0151
                             Standard Deviation   0.00722
                       Coefficient of Variation     0.436

               Mann-Kendall Statistics
                           M-K Test Value (S)    -101
                             Tabulated p-value   0.002
                        Standard Deviation of S   35.46
                        Standardized Value of S  -2.82
                            Approximate p-value  0.0024

       Approximate inference for Theil-Sen Trend Test
                               Number of Slopes   231
                                Theil-Sen Slope -7.857E-4
                            Theil-Sen Intercept    0.0241
                                            M2'   144.7
             One-sided 95% upper limit of Slope -4.033E-4
                       95% LCL of Slope (0.025)  -0.00117
                       95% UCL of Slope (0.975) -3.381E-4

Statistically significant evidence of a decreasing
trend at the specified level of significance.


       Theil-Sen Trend Test Estimates and Residuals
```

#	Events	Values	Estimates	Residuals
1	1	0.033	0.0233	0.0097
2	2	0.025	0.0225	0.00249
3	3	0.0128	0.0217	-0.00893
4	4	0.0245	0.0209	0.00356
5	5	0.0138	0.0202	-0.00636
6	6	0.0226	0.0194	0.00323
7	7	0.02	0.0186	0.00141
8	8	0.0284	0.0178	0.0106
9	9	0.0187	0.017	0.00169
10	10	0.0213	0.0162	0.00507
11	11	0.00993	0.0154	-0.00551
12	12	0.0161	0.0147	0.00144
13	13	0.00688	0.0139	-0.00699
14	14	0.0164	0.0131	0.00331
15	15	0.0111	0.0123	-0.0012
16	16	0.014	0.0115	0.00249
17	17	0.00767	0.0107	-0.00306
18	18	0.0114	0.00994	0.00146
19	19	0.00719	0.00916	-0.00197
20	20	0.0139	0.00837	0.00553
21	21	0.00872	0.00759	0.00113
22	22	0.0206	0.0068	0.0138

Result-background;bsl-1;arsenic;mg/l

General Statistics

Number of Events	33
Number of Values Reported (n)	33
Number of Values After Averaging	33
Number of Replicates	0
Minimum	0.0054
Maximum	0.012
Mean	0.00791
Geometric Mean	0.00777
Median	0.00784
Standard Deviation	0.00149
Coefficient of Variation	0.189

Mann-Kendall Statistics

M-K Test Value (S)	301
Critical Value (0.05)	1.645
Standard Deviation of S	64.53
Standardized Value of S	4.649
Approximate p-value	1.6687E-6

Approximate inference for Theil-Sen Trend Test

Number of Slopes	528
Theil-Sen Slope	1.0993E-4
Theil-Sen Intercept	0.00597
M1'	210.9
One-sided 95% lower limit of Slope	7.8992E-5

95% LCL of Slope (0.025)	7.1760E-5
95% UCL of Slope (0.975)	1.4874E-4

Statistically significant evidence of an increasing trend at the specified level of significance.

Theil-Sen Trend Test Estimates and Residuals

#	Events	Values	Estimates	Residuals
1	1	0.0057	0.00608	-3.811E-4
2	2	0.0054	0.00619	-7.910E-4
3	3	0.006	0.0063	-3.009E-4
4	4	0.006	0.00641	-4.109E-4
5	5	0.0073	0.00652	7.7920E-4
6	6	0.0076	0.00663	9.6926E-4
7	7	0.0059	0.00674	-8.407E-4
8	8	0.0064	0.00685	-4.506E-4
9	9	0.0069	0.00696	-6.054E-5
10	10	0.0077	0.00707	6.2953E-4
11	11	0.0081	0.00718	9.1960E-4
12	12	0.00716	0.00729	-1.303E-4
13	13	0.00671	0.0074	-6.903E-4
14	14	0.00768	0.00751	1.6980E-4
15	15	0.00947	0.00762	0.00185
16	16	0.00945	0.00773	0.00172
17	17	0.00861	0.00784	7.7000E-4
18	18	0.00697	0.00795	-9.799E-4
19	19	0.0082	0.00806	1.4013E-4
20	20	0.00688	0.00817	-0.00129
21	21	0.00799	0.00828	-2.897E-4
22	22	0.00823	0.00839	-1.597E-4
23	23	0.00784	0.0085	-6.596E-4
24	24	0.00844	0.00861	-1.695E-4
25	25	0.00808	0.00872	-6.395E-4
26	26	0.0101	0.00883	0.00127
27	27	0.0072	0.00894	-0.00174
28	28	0.012	0.00905	0.00295
29	29	0.00981	0.00916	6.5080E-4
30	30	0.0104	0.00927	0.00113
31	31	0.00912	0.00938	-2.591E-4
32	32	0.00917	0.00949	-3.190E-4
33	33	0.00837	0.0096	-0.00123

Result-compliance;bsl-2;arsenic;mg/l

General Statistics

Number of Events	76
Number of Values Reported (n)	76
Number of Values After Averaging	76
Number of Replicates	0
Minimum	0.00671
Maximum	0.0706
Mean	0.018

Geometric Mean	0.016
Median	0.0154
Standard Deviation	0.00964
Coefficient of Variation	0.537

Mann-Kendall Statistics

M-K Test Value (S)	-260
Critical Value (0.05)	-1.645
Standard Deviation of S	222.9
Standardized Value of S	-1.162
Approximate p-value	0.123

Approximate inference for Theil-Sen Trend Test

Number of Slopes	2850
Theil-Sen Slope	-4.936E-5
Theil-Sen Intercept	0.0173
M1	1207
M2	1643
95% LCL of Slope (0.025)	-1.431E-4
95% UCL of Slope (0.975)	3.0282E-5

Insufficient evidence to identify a significant trend at the specified level of significance.

Theil-Sen Trend Test Estimates and Residuals

#	Events	Values	Estimates	Residuals
1	1	0.0099	0.0172	-0.0073
2	2	0.0084	0.0172	-0.00875
3	3	0.01	0.0171	-0.0071
4	4	0.018	0.0171	9.4718E-4
5	5	0.013	0.017	-0.004
6	6	0.013	0.017	-0.00395
7	7	0.008	0.0169	-0.0089
8	8	0.015	0.0169	-0.00186
9	9	0.007	0.0168	-0.00981
10	10	0.011	0.0168	-0.00576
11	11	0.014	0.0167	-0.00271
12	12	0.0089	0.0167	-0.00776
13	13	0.024	0.0166	0.00739
14	14	0.026	0.0166	0.00944
15	15	0.018	0.0165	0.00149
16	16	0.019	0.0165	0.00254
17	17	0.02	0.0164	0.00359
18	18	0.021	0.0164	0.00464
19	19	0.023	0.0163	0.00669
20	20	0.0074	0.0163	-0.00886
21	21	0.026	0.0162	0.00979
22	22	0.041	0.0162	0.0248
23	23	0.02	0.0161	0.00388
24	24	0.02	0.0161	0.00393
25	25	0.026	0.016	0.00998

26	26	0.024	0.016	0.00803
27	27	0.0099	0.0159	-0.00602
28	28	0.027	0.0159	0.0111
29	29	0.027	0.0158	0.0112
30	30	0.024	0.0158	0.00823
31	31	0.019	0.0157	0.00328
32	32	0.032	0.0157	0.0163
33	33	0.0244	0.0156	0.00878
34	34	0.0253	0.0156	0.00973
35	35	0.0205	0.0155	0.00498
36	36	0.0299	0.0155	0.0144
37	37	0.0227	0.0154	0.00728
38	38	0.0193	0.0154	0.00393
39	39	0.024	0.0153	0.00867
40	40	0.0265	0.0153	0.0112
41	41	0.0266	0.0152	0.0114
42	42	0.0299	0.0152	0.0147
43	43	0.025	0.0151	0.00987
44	44	0.0362	0.0151	0.0211
45	45	0.0706	0.015	0.0556
46	46	0.0103	0.015	-0.00468
47	47	0.0092	0.0149	-0.00573
48	48	0.0092	0.0149	-0.00568
49	49	0.0138	0.0148	-0.00103
50	50	0.0147	0.0148	-8.239E-5
51	51	0.0122	0.0147	-0.00253
52	52	0.0123	0.0147	-0.00238
53	53	0.0163	0.0146	0.00167
54	54	0.0188	0.0146	0.00422
55	55	0.0124	0.0145	-0.00214
56	56	0.0142	0.0145	-2.862E-4
57	57	0.0141	0.0144	-3.369E-4
58	58	0.0176	0.0144	0.00321
59	59	0.00956	0.0143	-0.00478
60	60	0.0129	0.0143	-0.00139
61	61	0.0117	0.0142	-0.00254
62	62	0.0149	0.0142	7.0989E-4
63	63	0.00671	0.0141	-0.00743
64	64	0.00814	0.0141	-0.00595
65	65	0.00778	0.014	-0.00626
66	66	0.0186	0.014	0.00461
67	67	0.011	0.0139	-0.00294
68	68	0.011	0.0139	-0.00289
69	69	0.0114	0.0138	-0.00244
70	70	0.0133	0.0138	-4.953E-4
71	71	0.011	0.0137	-0.00275
72	72	0.0138	0.0137	1.0346E-4
73	73	0.0159	0.0136	0.00225
74	74	0.0148	0.0136	0.0012
75	75	0.0157	0.0135	0.00215
76	76	0.00959	0.0135	-0.00391

```
        Result-compliance;bsl-3;arsenic;mg/l

                  General Statistics
                          Number of Events     77
               Number of Values Reported (n)   77
             Number of Values After Averaging  77
                      Number of Replicates      0
                                   Minimum     0.027
                                   Maximum     0.0839
                                      Mean     0.0566
                            Geometric Mean     0.0553
                                    Median     0.0538
                        Standard Deviation     0.0119
                    Coefficient of Variation    0.211

                Mann-Kendall Statistics
                        M-K Test Value (S)    623
                       Critical Value (0.05)    1.645
                      Standard Deviation of S  227.3
                     Standardized Value of S    2.736
                         Approximate p-value   0.00311

      Approximate inference for Theil-Sen Trend Test
                          Number of Slopes   2926
                           Theil-Sen Slope 1.6667E-4
                        Theil-Sen Intercept     0.0473
                                        M1'  1276
            One-sided 95% lower limit of Slope 7.0050E-5
                    95% LCL of Slope (0.025) 5.0941E-5
                    95% UCL of Slope (0.975) 2.7778E-4

Statistically significant evidence of an increasing
trend at the specified level of significance.

      Theil-Sen Trend Test Estimates and Residuals
         #  Events     Values      Estimates   Residuals
         1     1        0.04         0.0475    -0.00747
         2     2        0.042        0.0476    -0.00563
         3     3        0.053        0.0478     0.0052
         4     4        0.046        0.048     -0.00197
         5     5        0.04         0.0481    -0.00813
         6     6        0.048        0.0483    -3.000E-4
         7     7        0.051        0.0485     0.00253
         8     8        0.053        0.0486     0.00437
         9     9        0.045        0.0488    -0.0038
        10    10        0.051        0.049      0.00203
        11    11        0.071        0.0491     0.0219
        12    12        0.064        0.0493     0.0147
        13    13        0.056        0.0495     0.00653
        14    14        0.076        0.0496     0.0264
        15    15        0.067        0.0498     0.0172
```

16	16	0.058	0.05	0.00803
17	17	0.046	0.0501	-0.00413
18	18	0.059	0.0503	0.0087
19	19	0.056	0.0505	0.00553
20	20	0.053	0.0506	0.00237
21	21	0.047	0.0508	-0.0038
22	22	0.073	0.051	0.022
23	23	0.037	0.0511	-0.0141
24	24	0.081	0.0513	0.0297
25	25	0.027	0.0515	-0.0245
26	26	0.079	0.0516	0.0274
27	27	0.05	0.0518	-0.0018
28	28	0.065	0.052	0.013
29	29	0.056	0.0521	0.00387
30	30	0.044	0.0523	-0.0083
31	31	0.048	0.0525	-0.00447
32	32	0.052	0.0526	-6.333E-4
33	33	0.046	0.0528	-0.0068
34	34	0.041	0.053	-0.012
35	35	0.0443	0.0531	-0.00883
36	36	0.0496	0.0533	-0.0037
37	37	0.0418	0.0535	-0.0117
38	38	0.0469	0.0536	-0.00673
39	39	0.0453	0.0538	-0.0085
40	40	0.0578	0.054	0.00383
41	41	0.0467	0.0541	-0.00743
42	42	0.0519	0.0543	-0.0024
43	43	0.0456	0.0545	-0.00887
44	44	0.0611	0.0546	0.00647
45	45	0.0718	0.0548	0.017
46	46	0.0601	0.055	0.00513
47	47	0.053	0.0551	-0.00213
48	48	0.0777	0.0553	0.0224
49	49	0.0711	0.0555	0.0156
50	50	0.0553	0.0556	-3.333E-4
51	51	0.0667	0.0558	0.0109
52	52	0.0697	0.056	0.0137
53	53	0.0716	0.0561	0.0155
54	54	0.0509	0.0563	-0.0054
55	55	0.0614	0.0565	0.00493
56	56	0.0816	0.0566	0.025
57	57	0.0646	0.0568	0.0078
58	58	0.0463	0.057	-0.0107
59	59	0.0497	0.0571	-0.00743
60	60	0.0733	0.0573	0.016
61	61	0.0642	0.0575	0.00673
62	62	0.0516	0.0576	-0.00603
63	63	0.0589	0.0578	0.0011
64	64	0.066	0.058	0.00803
65	65	0.0528	0.0581	-0.00533
66	66	0.055	0.0583	-0.0033

67	67	0.0538	0.0585	-0.00467
68	68	0.0587	0.0586	6.6667E-5
69	69	0.0417	0.0588	-0.0171
70	70	0.0542	0.059	-0.00477
71	71	0.0712	0.0591	0.0121
72	72	0.0839	0.0593	0.0246
73	73	0.0685	0.0595	0.00903
74	74	0.0529	0.0596	-0.00673
75	75	0.0645	0.0598	0.0047
76	76	0.0705	0.06	0.0105
77	77	0.0524	0.0601	-0.00773

```
                    Goodness-of-Fit Test Statistics for Uncensored Full Data Sets without Non-Detects
         User Selected Options
    Date/Time of Computation   ProUCL 5.12/10/2022 12:44:11 PM
                   From File   qryJDW_ProUCL_Input_D0_20220210.xls
              Full Precision   OFF
      Confidence Coefficient   0.95


Result (background;bg-1;arsenic;mg/l)

                       Raw Statistics
                          Number of Valid Observations     2
                       Number of Distinct Observations     2
                                               Minimum   0.023
                                               Maximum   0.026

                              Warning: This data set only has 2 observations!
                     Data set is too small to compute reliable and meaningful statistics and estimates!
                    The data set for variable Result (background;bg-1;arsenic;mg/l) was not processed!

                  It is suggested to collect at least 8 to 10 observations before using these statistical methods!
              If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.



Result (background;bg-2;arsenic;mg/l)

                       Raw Statistics
                          Number of Valid Observations     2
                       Number of Distinct Observations     2
                                               Minimum   0.025
                                               Maximum   0.033

                              Warning: This data set only has 2 observations!
                     Data set is too small to compute reliable and meaningful statistics and estimates!
                    The data set for variable Result (background;bg-2;arsenic;mg/l) was not processed!

                  It is suggested to collect at least 8 to 10 observations before using these statistical methods!
              If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.



Result (background;bsl-1;arsenic;mg/l)

                       Raw Statistics
                          Number of Valid Observations    11
                       Number of Distinct Observations    10
                                               Minimum   0.0054
                                               Maximum   0.0081
                                      Mean of Raw Data   0.00664
                         Standard Deviation of Raw Data 9.2333E-4
```

Khat	57.49
Theta hat	1.1543E-4
Kstar	41.87
Theta star	1.5849E-4
Mean of Log Transformed Data	-5.024
Standard Deviation of Log Transformed Data	0.138

Normal GOF Test Results

Correlation Coefficient R	0.971
Shapiro Wilk Test Statistic	0.925
Shapiro Wilk Critical (0.05) Value	0.85
Approximate Shapiro Wilk P Value	0.469
Lilliefors Test Statistic	0.209
Lilliefors Critical (0.05) Value	0.251

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.972
A-D Test Statistic	0.417
A-D Critical (0.05) Value	0.728
K-S Test Statistic	0.215
K-S Critical(0.05) Value	0.255

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.974
Shapiro Wilk Test Statistic	0.931
Shapiro Wilk Critical (0.05) Value	0.85
Approximate Shapiro Wilk P Value	0.543
Lilliefors Test Statistic	0.202
Lilliefors Critical (0.05) Value	0.251

Data appear Lognormal at (0.05) Significance Level

Result (compliance;bsl-2;arsenic;mg/l)

Raw Statistics

Number of Valid Observations	32
Number of Distinct Observations	21
Minimum	0.007
Maximum	0.041
Mean of Raw Data	0.0185
Standard Deviation of Raw Data	0.00814
Khat	5.057
Theta hat	0.00365
Kstar	4.604
Theta star	0.00401
Mean of Log Transformed Data	-4.095
Standard Deviation of Log Transformed Data	0.474

Normal GOF Test Results

Correlation Coefficient R	0.972
Shapiro Wilk Test Statistic	0.942
Shapiro Wilk Critical (0.05) Value	0.93
Approximate Shapiro Wilk P Value	0.108
Lilliefors Test Statistic	0.101
Lilliefors Critical (0.05) Value	0.154

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.981
A-D Test Statistic	0.601
A-D Critical (0.05) Value	0.748
K-S Test Statistic	0.131
K-S Critical(0.05) Value	0.156

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.976
Shapiro Wilk Test Statistic	0.941
Shapiro Wilk Critical (0.05) Value	0.93
Approximate Shapiro Wilk P Value	0.0983
Lilliefors Test Statistic	0.159
Lilliefors Critical (0.05) Value	0.154

Data appear Approximate_Lognormal at (0.05) Significance Level

Result (compliance;bsl-3;arsenic;mg/l)

Raw Statistics

Number of Valid Observations	33
Number of Distinct Observations	24
Minimum	0.027
Maximum	0.081
Mean of Raw Data	0.0539
Standard Deviation of Raw Data	0.0125
Khat	19.12
Theta hat	0.00282
Kstar	17.4
Theta star	0.0031
Mean of Log Transformed Data	-2.946
Standard Deviation of Log Transformed Data	0.235

Normal GOF Test Results

Correlation Coefficient R	0.98
Shapiro Wilk Test Statistic	0.959
Shapiro Wilk Critical (0.05) Value	0.931

Approximate Shapiro Wilk P Value	0.301
Lilliefors Test Statistic	0.136
Lilliefors Critical (0.05) Value	0.152

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.987
A-D Test Statistic	0.354
A-D Critical (0.05) Value	0.746
K-S Test Statistic	0.106
K-S Critical(0.05) Value	0.153

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.982
Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical (0.05) Value	0.931
Approximate Shapiro Wilk P Value	0.547
Lilliefors Test Statistic	0.0911
Lilliefors Critical (0.05) Value	0.152

Data appear Lognormal at (0.05) Significance Level

Background Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation	ProUCL 5.12/10/2022 12:46:10 PM
From File	P:\GIS\SLC1044 - Bountiful Landfill\Database\Export\20220210\D0 2002-2010\qryJDW_ProUCL_Input_D0_202
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
New or Future K Observations	1
Number of Bootstrap Operations	2000

Result (background;bg-1;arsenic;mg/l)

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
Minimum	0.023	First Quartile	0.0238
Second Largest	0.023	Median	0.0245
Maximum	0.026	Third Quartile	0.0253
Mean	0.0245	SD	0.00212
Coefficient of Variation	0.0866	Skewness	N/A

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Result (background;bg-1;arsenic;mg/l) was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Result (background;bg-2;arsenic;mg/l)

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
Minimum	0.025	First Quartile	0.027
Second Largest	0.025	Median	0.029
Maximum	0.033	Third Quartile	0.031
Mean	0.029	SD	0.00566
Coefficient of Variation	0.195	Skewness	N/A

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Result (background;bg-2;arsenic;mg/l) was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Result (background;bsl-1;arsenic;mg/l)

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
Minimum	0.0054	First Quartile	0.00595

Second Largest	0.0077	Median	0.0064
Maximum	0.0081	Third Quartile	0.00745
Mean	0.00664	SD	9.2333E-4
Coefficient of Variation	0.139	Skewness	0.296
Mean of logged Data	-5.024	SD of logged Data	0.138

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.815	d2max (for USL)	2.234

Normal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.209	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.00924	90% Percentile (z)	0.00782
95% UPL (t)	0.00838	95% Percentile (z)	0.00816
95% USL	0.0087	99% Percentile (z)	0.00878

Gamma GOF Test

A-D Test Statistic	0.417	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.215	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	57.49	k star (bias corrected MLE)	41.87
Theta hat (MLE)	1.1543E-4	Theta star (bias corrected MLE)	1.5849E-4
nu hat (MLE)	1265	nu star (bias corrected)	921.2
MLE Mean (bias corrected)	0.00664	MLE Sd (bias corrected)	0.00103

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.00849	90% Percentile	0.00798
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0085	95% Percentile	0.00841
95% WH Approx. Gamma UTL with 95% Coverage	0.00952	99% Percentile	0.00925
95% HW Approx. Gamma UTL with 95% Coverage	0.00957		
95% WH USL	0.00886	95% HW USL	0.00888

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.00971	90% Percentile (z)	0.00785
95% UPL (t)	0.00855	95% Percentile (z)	0.00826

95% USL	0.00896	99% Percentile (z)	0.00907

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	11	95% UTL with 95% Coverage	0.0081
Approx, f used to compute achieved CC	0.579	Approximate Actual Confidence Coefficient achieved by UTL	0.431
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.0081	95% BCA Bootstrap UTL with 95% Coverage	0.0081
95% UPL	0.0081	90% Percentile	0.0077
90% Chebyshev UPL	0.00953	95% Percentile	0.0079
95% Chebyshev UPL	0.0108	99% Percentile	0.00806
95% USL	0.0081		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (compliance;bsl-2;arsenic;mg/l)

General Statistics

Total Number of Observations	32	Number of Distinct Observations	21
Minimum	0.007	First Quartile	0.0108
Second Largest	0.032	Median	0.019
Maximum	0.041	Third Quartile	0.024
Mean	0.0185	SD	0.00814
Coefficient of Variation	0.441	Skewness	0.542
Mean of logged Data	-4.095	SD of logged Data	0.474

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.186	d2max (for USL)	2.773

Normal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.101	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.0363	90% Percentile (z)	0.0289
95% UPL (t)	0.0325	95% Percentile (z)	0.0318
95% USL	0.041	99% Percentile (z)	0.0374

Gamma GOF Test

A-D Test Statistic	0.601	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.131	**Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value	0.156	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.057	k star (bias corrected MLE)	4.604
Theta hat (MLE)	0.00365	Theta star (bias corrected MLE)	0.00401
nu hat (MLE)	323.7	nu star (bias corrected)	294.7
MLE Mean (bias corrected)	0.0185	MLE Sd (bias corrected)	0.0086

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.035	90% Percentile	0.03
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0355	95% Percentile	0.0345
95% WH Approx. Gamma UTL with 95% Coverage	0.0413	99% Percentile	0.0441
95% HW Approx. Gamma UTL with 95% Coverage	0.0424		
95% WH USL	0.0502	95% HW USL	0.0524

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.159	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.0469	90% Percentile (z)	0.0306
95% UPL (t)	0.0377	95% Percentile (z)	0.0363
95% USL	0.062	99% Percentile (z)	0.0501

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	32	95% UTL with 95% Coverage	0.041
Approx, f used to compute achieved CC	1.684	Approximate Actual Confidence Coefficient achieved by UTL	0.806
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.041	95% BCA Bootstrap UTL with 95% Coverage	0.0361
95% UPL	0.0352	90% Percentile	0.0269
90% Chebyshev UPL	0.0433	95% Percentile	0.0293
95% Chebyshev UPL	0.0545	99% Percentile	0.0382
95% USL	0.041		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (compliance;bsl-3;arsenic;mg/l)

General Statistics

Total Number of Observations	33	Number of Distinct Observations	24

Minimum	0.027	First Quartile	0.046
Second Largest	0.079	Median	0.052
Maximum	0.081	Third Quartile	0.059
Mean	0.0539	SD	0.0125
Coefficient of Variation	0.232	Skewness	0.464
Mean of logged Data	-2.946	SD of logged Data	0.235

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.176	d2max (for USL)	2.787

Normal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.136	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.0812	90% Percentile (z)	0.07
95% UPL (t)	0.0755	95% Percentile (z)	0.0745
95% USL	0.0888	99% Percentile (z)	0.0831

Gamma GOF Test

A-D Test Statistic	0.354	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.106	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.153	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	19.12	k star (bias corrected MLE)	17.4
Theta hat (MLE)	0.00282	Theta star (bias corrected MLE)	0.0031
nu hat (MLE)	1262	nu star (bias corrected)	1149
MLE Mean (bias corrected)	0.0539	MLE Sd (bias corrected)	0.0129

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0773	90% Percentile	0.071
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0776	95% Percentile	0.0768
95% WH Approx. Gamma UTL with 95% Coverage	0.0848	99% Percentile	0.0885
95% HW Approx. Gamma UTL with 95% Coverage	0.0854		
95% WH USL	0.0955	95% HW USL	0.0967

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0911	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.0877	90% Percentile (z)	0.071

95% UPL (t)	0.0788	95% Percentile (z)	0.0774
95% USL	0.101	99% Percentile (z)	0.0909

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	33	95% UTL with 95% Coverage	0.081
Approx, f used to compute achieved CC	1.737	Approximate Actual Confidence Coefficient achieved by UTL	0.816
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.081	95% BCA Bootstrap UTL with 95% Coverage	0.081
95% UPL	0.0796	90% Percentile	0.0726
90% Chebyshev UPL	0.0921	95% Percentile	0.0772
95% Chebyshev UPL	0.109	99% Percentile	0.0804
95% USL	0.081		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.

The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

```
                    Mann-Kendall Trend Test Analysis
      User Selected Options
  Date/Time of Computation  ProUCL 5.12/10/2022 12:45:30 PM
                 From File  qryJDW_ProUCL_Input_D0_20220210.xls
            Full Precision  OFF
    Confidence Coefficient  0.95
     Level of Significance  0.05

Result-background;bg-1;arsenic;mg/l

             General Statistics
     Number of Events Reported (m)    2
         Number of Missing Events     0
    Number or Reported Events Used    2
        Number Values Reported (n)    2
                           Minimum    0.023
                           Maximum    0.026
                              Mean    0.0245
                    Geometric Mean    0.0245
                            Median    0.0245
                Standard Deviation   0.00212
          Coefficient of Variation    0.0866
                       Not enough reported values (n) to provide Mann-Kendall Statistics!

Result-background;bg-2;arsenic;mg/l

             General Statistics
     Number of Events Reported (m)    2
         Number of Missing Events     0
    Number or Reported Events Used    2
        Number Values Reported (n)    2
                           Minimum    0.025
                           Maximum    0.033
                              Mean    0.029
                    Geometric Mean    0.0287
                            Median    0.029
                Standard Deviation   0.00566
          Coefficient of Variation     0.195
                       Not enough reported values (n) to provide Mann-Kendall Statistics!

Result-background;bsl-1;arsenic;mg/l

             General Statistics
     Number of Events Reported (m)    11
         Number of Missing Events     0
    Number or Reported Events Used    11
        Number Values Reported (n)    11
                           Minimum   0.0054
                           Maximum   0.0081
                              Mean   0.00664
                    Geometric Mean   0.00658
```

Median	0.0064
Standard Deviation	9.2333E-4
Coefficient of Variation	0.139

Mann-Kendall Test

M-K Test Value (S)	36
Tabulated p-value	0.002
Standard Deviation of S	12.81
Standardized Value of S	2.733
Approximate p-value	0.00314

Statistically significant evidence of an increasing trend at the specified level of significance.

Result-compliance;bsl-2;arsenic;mg/l

General Statistics

Number of Events Reported (m)	32
Number of Missing Events	0
Number or Reported Events Used	32
Number Values Reported (n)	32
Minimum	0.007
Maximum	0.041
Mean	0.0185
Geometric Mean	0.0167
Median	0.019
Standard Deviation	0.00814
Coefficient of Variation	0.441

Mann-Kendall Test

M-K Test Value (S)	242
Critical Value (0.05)	1.645
Standard Deviation of S	61.54
Standardized Value of S	3.916
Approximate p-value	4.4938E-5

Statistically significant evidence of an increasing trend at the specified level of significance.

Result-compliance;bsl-3;arsenic;mg/l

General Statistics

Number of Events Reported (m)	33
Number of Missing Events	0
Number or Reported Events Used	33
Number Values Reported (n)	33
Minimum	0.027
Maximum	0.081
Mean	0.0539
Geometric Mean	0.0525
Median	0.052
Standard Deviation	0.0125
Coefficient of Variation	0.232

Mann-Kendall Test

M-K Test Value (S)	62
Critical Value (0.05)	1.645
Standard Deviation of S	64.43
Standardized Value of S	0.947
Approximate p-value	0.172

Insufficient evidence to identify a significant trend at the specified level of significance.

```
                        Theil-Sen Trend Test Analysis
         User Selected Options
  Date/Time of Computation  ProUCL 5.12/10/2022 12:45:43 PM
                 From File  qryJDW_ProUCL_Input_D0_20220210.xls
            Full Precision  OFF
        Average Replicates  Replicates at sampling events will be averaged!
    Confidence Coefficient  0.95
        Level of Significance  0.05

Result-background;bg-1;arsenic;mg/l

           General Statistics
                      Number of Events   2
              Number of Values Reported (n)   2
          Number of Values After Averaging   2
                  Number of Replicates   0
                             Minimum   0.023
                             Maximum   0.026
                                Mean   0.0245
                      Geometric Mean   0.0245
                              Median   0.0245
                  Standard Deviation   0.00212
              Coefficient of Variation   0.0866

                     Not enough reported values (n) to provide Theil-Sen Statistics!

Result-background;bg-2;arsenic;mg/l

           General Statistics
                      Number of Events   2
              Number of Values Reported (n)   2
          Number of Values After Averaging   2
                  Number of Replicates   0
                             Minimum   0.025
                             Maximum   0.033
                                Mean   0.029
                      Geometric Mean   0.0287
                              Median   0.029
                  Standard Deviation   0.00566
              Coefficient of Variation   0.195

                     Not enough reported values (n) to provide Theil-Sen Statistics!

Result-background;bsl-1;arsenic;mg/l

           General Statistics
                      Number of Events   11
              Number of Values Reported (n)   11
          Number of Values After Averaging   11
                  Number of Replicates   0
                             Minimum   0.0054
```

Maximum	0.0081
Mean	0.00664
Geometric Mean	0.00658
Median	0.0064
Standard Deviation	9.2333E-4
Coefficient of Variation	0.139

Mann-Kendall Statistics

M-K Test Value (S)	36
Tabulated p-value	0.002
Standard Deviation of S	12.81
Standardized Value of S	2.733
Approximate p-value	0.00314

Approximate inference for Theil-Sen Trend Test

Number of Slopes	55
Theil-Sen Slope	2.4000E-4
Theil-Sen Intercept	0.00496
M1'	16.97
One-sided 95% lower limit of Slope	1.0000E-4
95% LCL of Slope (0.025)	9.9002E-5
95% UCL of Slope (0.975)	5.0000E-4

Statistically significant evidence of an increasing trend at the specified level of significance.

Theil-Sen Trend Test Estimates and Residuals

#	Events	Values	Estimates	Residuals
1	1	0.0057	0.0052	5.0000E-4
2	2	0.0054	0.00544	-4.000E-5
3	3	0.006	0.00568	3.2000E-4
4	4	0.006	0.00592	8.0000E-5
5	5	0.0073	0.00616	0.00114
6	6	0.0076	0.0064	0.0012
7	7	0.0059	0.00664	-7.400E-4
8	8	0.0064	0.00688	-4.800E-4
9	9	0.0069	0.00712	-2.200E-4
10	10	0.0077	0.00736	3.4000E-4
11	11	0.0081	0.0076	5.0000E-4

Result-compliance;bsl-2;arsenic;mg/l

General Statistics

Number of Events	32
Number of Values Reported (n)	32
Number of Values After Averaging	32
Number of Replicates	0
Minimum	0.007
Maximum	0.041
Mean	0.0185
Geometric Mean	0.0167
Median	0.019

```
                    Standard Deviation    0.00814
                Coefficient of Variation    0.441

        Mann-Kendall Statistics
                    M-K Test Value (S)    242
                    Critical Value (0.05)    1.645
                  Standard Deviation of S    61.54
                  Standardized Value of S    3.916
                    Approximate p-value 4.4938E-5

   Approximate inference for Theil-Sen Trend Test
                       Number of Slopes    496
                         Theil-Sen Slope 6.0333E-4
                      Theil-Sen Intercept    0.00905
                                     M1'    197.4
        One-sided 95% lower limit of Slope 4.0356E-4
                 95% LCL of Slope (0.025) 3.6384E-4
                 95% UCL of Slope (0.975) 7.6486E-4

Statistically significant evidence of an increasing
trend at the specified level of significance.

   Theil-Sen Trend Test Estimates and Residuals
     #   Events      Values     Estimates   Residuals
     1     1         0.0099      0.00965   2.5167E-4
     2     2         0.0084      0.0103     -0.00185
     3     3          0.01       0.0109    -8.550E-4
     4     4          0.018      0.0115      0.00654
     5     5          0.013      0.0121    9.3833E-4
     6     6          0.013      0.0127    3.3500E-4
     7     7         0.008       0.0133     -0.00527
     8     8          0.015      0.0139      0.00113
     9     9         0.007       0.0145     -0.00748
    10    10          0.011      0.0151     -0.00408
    11    11          0.014      0.0157     -0.00168
    12    12         0.0089      0.0163     -0.00739
    13    13          0.024      0.0169      0.00711
    14    14          0.026      0.0175      0.00851
    15    15          0.018      0.0181    -9.500E-5
    16    16          0.019      0.0187    3.0167E-4
    17    17          0.02       0.0193    6.9833E-4
    18    18          0.021      0.0199      0.0011
    19    19          0.023      0.0205      0.00249
    20    20         0.0074      0.0211      -0.0137
    21    21          0.026      0.0217      0.00429
    22    22          0.041      0.0223       0.0187
    23    23          0.02       0.0229     -0.00292
    24    24          0.02       0.0235     -0.00353
    25    25          0.026      0.0241      0.00187
    26    26          0.024      0.0247    -7.317E-4
    27    27         0.0099      0.0253      -0.0154
```

28	28	0.027	0.0259	0.00106
29	29	0.027	0.0265	4.5833E-4
30	30	0.024	0.0271	-0.00315
31	31	0.019	0.0277	-0.00875
32	32	0.032	0.0284	0.00365

Result-compliance;bsl-3;arsenic;mg/l

General Statistics

Number of Events	33
Number of Values Reported (n)	33
Number of Values After Averaging	33
Number of Replicates	0
Minimum	0.027
Maximum	0.081
Mean	0.0539
Geometric Mean	0.0525
Median	0.052
Standard Deviation	0.0125
Coefficient of Variation	0.232

Mann-Kendall Statistics

M-K Test Value (S)	62
Critical Value (0.05)	1.645
Standard Deviation of S	64.43
Standardized Value of S	0.947
Approximate p-value	0.172

Approximate inference for Theil-Sen Trend Test

Number of Slopes	528
Theil-Sen Slope	2.0345E-4
Theil-Sen Intercept	0.0485
M1	200.9
M2	327.1
95% LCL of Slope (0.025)	-2.196E-4
95% UCL of Slope (0.975)	6.6914E-4

Insufficient evidence to identify a significant trend at the specified level of significance.

Theil-Sen Trend Test Estimates and Residuals

#	Events	Values	Estimates	Residuals
1	1	0.04	0.0487	-0.00874
2	2	0.042	0.0489	-0.00695
3	3	0.053	0.0492	0.00385
4	4	0.046	0.0494	-0.00336
5	5	0.04	0.0496	-0.00956
6	6	0.048	0.0498	-0.00176
7	7	0.051	0.05	0.00103
8	8	0.053	0.0502	0.00283
9	9	0.045	0.0504	-0.00537
10	10	0.051	0.0506	4.2414E-4

11	11	0.071	0.0508	0.0202
12	12	0.064	0.051	0.013
13	13	0.056	0.0512	0.00481
14	14	0.076	0.0514	0.0246
15	15	0.067	0.0516	0.0154
16	16	0.058	0.0518	0.0062
17	17	0.046	0.052	-0.006
18	18	0.059	0.0522	0.0068
19	19	0.056	0.0524	0.00359
20	20	0.053	0.0526	3.8966E-4
21	21	0.047	0.0528	-0.00581
22	22	0.073	0.053	0.02
23	23	0.037	0.0532	-0.0162
24	24	0.081	0.0534	0.0276
25	25	0.027	0.0536	-0.0266
26	26	0.079	0.0538	0.0252
27	27	0.05	0.054	-0.00403
28	28	0.065	0.0542	0.0108
29	29	0.056	0.0544	0.00156
30	30	0.044	0.0546	-0.0106
31	31	0.048	0.0548	-0.00685
32	32	0.052	0.0551	-0.00305
33	33	0.046	0.0553	-0.00926

```
                         Goodness-of-Fit Test Statistics for Uncensored Full Data Sets without Non-Detects
          User Selected Options
     Date/Time of Computation  ProUCL 5.12/8/2022 8:34:57 PM
                    From File  qryJDW_ProUCL_Input_As_D2.xls
               Full Precision  OFF
       Confidence Coefficient  0.95


Result (background;bg-1;arsenic;mg/l)

                      Raw Statistics
                 Number of Valid Observations   10
              Number of Distinct Observations   10
                                      Minimum   0.0231
                                      Maximum   0.0476
                             Mean of Raw Data   0.0333
               Standard Deviation of Raw Data  0.00959
                                         Khat   13.31
                                    Theta hat  0.0025
                                        Kstar    9.386
                                   Theta star  0.00355
              Mean of Log Transformed Data  -3.441
   Standard Deviation of Log Transformed Data    0.292

                  Normal GOF Test Results

                      Correlation Coefficient R    0.944
                    Shapiro Wilk Test Statistic    0.865
              Shapiro Wilk Critical (0.05) Value    0.842
             Approximate Shapiro Wilk P Value    0.143
                      Lilliefors Test Statistic    0.217
               Lilliefors Critical (0.05) Value    0.262
Data appear Normal at (0.05) Significance Level

                  Gamma GOF Test Results

                      Correlation Coefficient R    0.948
                            A-D Test Statistic    0.678
                     A-D Critical (0.05) Value    0.725
                            K-S Test Statistic    0.231
                      K-S Critical(0.05)  Value    0.266
Data appear Gamma Distributed at (0.05) Significance Level

                 Lognormal GOF Test Results

                      Correlation Coefficient R    0.941
                    Shapiro Wilk Test Statistic    0.855
              Shapiro Wilk Critical (0.05) Value    0.842
             Approximate Shapiro Wilk P Value    0.116
                      Lilliefors Test Statistic    0.217
               Lilliefors Critical (0.05) Value    0.262
```

Data appear Lognormal at (0.05) Significance Level

Result (background;bg-2;arsenic;mg/l)

Raw Statistics

Number of Valid Observations	10
Number of Distinct Observations	10
Minimum	0.00688
Maximum	0.0206
Mean of Raw Data	0.0118
Standard Deviation of Raw Data	0.00448
Khat	8.089
Theta hat	0.00146
Kstar	5.729
Theta star	0.00206
Mean of Log Transformed Data	-4.504
Standard Deviation of Log Transformed Data	0.373

Normal GOF Test Results

Correlation Coefficient R	0.965
Shapiro Wilk Test Statistic	0.923
Shapiro Wilk Critical (0.05) Value	0.842
Approximate Shapiro Wilk P Value	0.426
Lilliefors Test Statistic	0.153
Lilliefors Critical (0.05) Value	0.262

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.987
A-D Test Statistic	0.287
A-D Critical (0.05) Value	0.727
K-S Test Statistic	0.157
K-S Critical(0.05) Value	0.267

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.98
Shapiro Wilk Test Statistic	0.945
Shapiro Wilk Critical (0.05) Value	0.842
Approximate Shapiro Wilk P Value	0.74
Lilliefors Test Statistic	0.138
Lilliefors Critical (0.05) Value	0.262

Data appear Lognormal at (0.05) Significance Level

Result (background;bsl-1;arsenic;mg/l)

Raw Statistics

Number of Valid Observations	10

Number of Distinct Observations	10
Minimum	0.0072
Maximum	0.012
Mean of Raw Data	0.00927
Standard Deviation of Raw Data	0.00137
Khat	51.93
Theta hat	1.7848E-4
Kstar	36.42
Theta star	2.5451E-4
Mean of Log Transformed Data	-4.691
Standard Deviation of Log Transformed Data	0.146

Normal GOF Test Results

Correlation Coefficient R	0.982
Shapiro Wilk Test Statistic	0.972
Shapiro Wilk Critical (0.05) Value	0.842
Approximate Shapiro Wilk P Value	0.849
Lilliefors Test Statistic	0.129
Lilliefors Critical (0.05) Value	0.262

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.989
A-D Test Statistic	0.169
A-D Critical (0.05) Value	0.724
K-S Test Statistic	0.132
K-S Critical(0.05) Value	0.266

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.99
Shapiro Wilk Test Statistic	0.987
Shapiro Wilk Critical (0.05) Value	0.842
Approximate Shapiro Wilk P Value	0.974
Lilliefors Test Statistic	0.118
Lilliefors Critical (0.05) Value	0.262

Data appear Lognormal at (0.05) Significance Level

Result (compliance;bsl-2;arsenic;mg/l)

Raw Statistics

Number of Valid Observations	20
Number of Distinct Observations	18
Minimum	0.00671
Maximum	0.0186
Mean of Raw Data	0.0125
Standard Deviation of Raw Data	0.00326
Khat	14.6

Theta hat	8.5460E-4
Kstar	12.44
Theta star	0.001
Mean of Log Transformed Data	-4.419
Standard Deviation of Log Transformed Data	0.276

Normal GOF Test Results

Correlation Coefficient R	0.994
Shapiro Wilk Test Statistic	0.981
Shapiro Wilk Critical (0.05) Value	0.905
Approximate Shapiro Wilk P Value	0.946
Lilliefors Test Statistic	0.0939
Lilliefors Critical (0.05) Value	0.192

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.989
A-D Test Statistic	0.209
A-D Critical (0.05) Value	0.741
K-S Test Statistic	0.101
K-S Critical(0.05) Value	0.194

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.986
Shapiro Wilk Test Statistic	0.968
Shapiro Wilk Critical (0.05) Value	0.905
Approximate Shapiro Wilk P Value	0.718
Lilliefors Test Statistic	0.121
Lilliefors Critical (0.05) Value	0.192

Data appear Lognormal at (0.05) Significance Level

Result (compliance;bsl-3;arsenic;mg/l)

Raw Statistics

Number of Valid Observations	20
Number of Distinct Observations	20
Minimum	0.0417
Maximum	0.0839
Mean of Raw Data	0.0595
Standard Deviation of Raw Data	0.0105
Khat	34.86
Theta hat	0.00171
Kstar	29.67
Theta star	0.00201
Mean of Log Transformed Data	-2.836
Standard Deviation of Log Transformed Data	0.174

Normal GOF Test Results

Correlation Coefficient R	0.979
Shapiro Wilk Test Statistic	0.96
Shapiro Wilk Critical (0.05) Value	0.905
Approximate Shapiro Wilk P Value	0.565
Lilliefors Test Statistic	0.166
Lilliefors Critical (0.05) Value	0.192

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.987
A-D Test Statistic	0.338
A-D Critical (0.05) Value	0.74
K-S Test Statistic	0.156
K-S Critical(0.05) Value	0.193

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.987
Shapiro Wilk Test Statistic	0.976
Shapiro Wilk Critical (0.05) Value	0.905
Approximate Shapiro Wilk P Value	0.865
Lilliefors Test Statistic	0.144
Lilliefors Critical (0.05) Value	0.192

Data appear Lognormal at (0.05) Significance Level

Background Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation	ProUCL 5.12/8/2022 8:38:23 PM
From File	P:\GIS\SLC1044 - Bountiful Landfill\Database\Export\20220207\D2\qryJDW_ProUCL_Input_As_D2.xlsx
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
New or Future K Observations	1
Number of Bootstrap Operations	2000

Result (background;bg-1;arsenic;mg/l)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Minimum	0.0231	First Quartile	0.0239
Second Largest	0.0437	Median	0.0328
Maximum	0.0476	Third Quartile	0.0412
Mean	0.0333	SD	0.00959
Coefficient of Variation	0.288	Skewness	0.206
Mean of logged Data	-3.441	SD of logged Data	0.292

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.0612	90% Percentile (z)	0.0456
95% UPL (t)	0.0517	95% Percentile (z)	0.049
95% USL	0.0541	99% Percentile (z)	0.0556

Gamma GOF Test

A-D Test Statistic	0.678	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.231	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.31	k star (bias corrected MLE)	9.386
Theta hat (MLE)	0.0025	Theta star (bias corrected MLE)	0.00355
nu hat (MLE)	266.3	nu star (bias corrected)	187.7
MLE Mean (bias corrected)	0.0333	MLE Sd (bias corrected)	0.0109

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0543	90% Percentile	0.0477

95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0547	95% Percentile	0.0529
95% WH Approx. Gamma UTL with 95% Coverage	0.0685	99% Percentile	0.0636
95% HW Approx. Gamma UTL with 95% Coverage	0.0699		
95% WH USL	0.0577	95% HW USL	0.0583

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.855	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.0749	90% Percentile (z)	0.0466
95% UPL (t)	0.0561	95% Percentile (z)	0.0518
95% USL	0.0604	99% Percentile (z)	0.0631

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	0.0476
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.0476	95% BCA Bootstrap UTL with 95% Coverage	0.0476
95% UPL	0.0476	90% Percentile	0.0441
90% Chebyshev UPL	0.0634	95% Percentile	0.0458
95% Chebyshev UPL	0.0771	99% Percentile	0.0472
95% USL	0.0476		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (background;bg-2;arsenic;mg/l)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Minimum	0.00688	First Quartile	0.00793
Second Largest	0.0164	Median	0.0113
Maximum	0.0206	Third Quartile	0.014
Mean	0.0118	SD	0.00448
Coefficient of Variation	0.38	Skewness	0.756
Mean of logged Data	-4.504	SD of logged Data	0.373

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.153	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.0248	90% Percentile (z)	0.0175
95% UPL (t)	0.0204	95% Percentile (z)	0.0192
95% USL	0.0215	99% Percentile (z)	0.0222

Gamma GOF Test

A-D Test Statistic	0.287	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.157	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.089	k star (bias corrected MLE)	5.729
Theta hat (MLE)	0.00146	Theta star (bias corrected MLE)	0.00206
nu hat (MLE)	161.8	nu star (bias corrected)	114.6
MLE Mean (bias corrected)	0.0118	MLE Sd (bias corrected)	0.00492

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0216	90% Percentile	0.0184
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0218	95% Percentile	0.0209
95% WH Approx. Gamma UTL with 95% Coverage	0.0287	99% Percentile	0.0261
95% HW Approx. Gamma UTL with 95% Coverage	0.0295		
95% WH USL	0.0233	95% HW USL	0.0236

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.138	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.0328	90% Percentile (z)	0.0178
95% UPL (t)	0.0227	95% Percentile (z)	0.0204
95% USL	0.0249	99% Percentile (z)	0.0264

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	0.0206
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.0206	95% BCA Bootstrap UTL with 95% Coverage	0.0206

95% UPL	0.0206	90% Percentile	0.0168
90% Chebyshev UPL	0.0259	95% Percentile	0.0187
95% Chebyshev UPL	0.0323	99% Percentile	0.0202
95% USL	0.0206		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (background;bsl-1;arsenic;mg/l)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Minimum	0.0072	First Quartile	0.00839
Second Largest	0.0104	Median	0.00915
Maximum	0.012	Third Quartile	0.01
Mean	0.00927	SD	0.00137
Coefficient of Variation	0.148	Skewness	0.576
Mean of logged Data	-4.691	SD of logged Data	0.146

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.129	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.0133	90% Percentile (z)	0.011
95% UPL (t)	0.0119	95% Percentile (z)	0.0115
95% USL	0.0123	99% Percentile (z)	0.0125

Gamma GOF Test

A-D Test Statistic	0.169	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.132	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	51.93	k star (bias corrected MLE)	36.42
Theta hat (MLE)	1.7848E-4	Theta star (bias corrected MLE)	2.5451E-4
nu hat (MLE)	1039	nu star (bias corrected)	728.4
MLE Mean (bias corrected)	0.00927	MLE Sd (bias corrected)	0.00154

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0121	90% Percentile	0.0113
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0121	95% Percentile	0.0119
95% WH Approx. Gamma UTL with 95% Coverage	0.0137	99% Percentile	0.0132
95% HW Approx. Gamma UTL with 95% Coverage	0.0138		
95% WH USL	0.0125	95% HW USL	0.0125

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.987	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.118	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.014	90% Percentile (z)	0.0111
95% UPL (t)	0.0122	95% Percentile (z)	0.0117
95% USL	0.0126	99% Percentile (z)	0.0129

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	0.012
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.012	95% BCA Bootstrap UTL with 95% Coverage	0.012
95% UPL	0.012	90% Percentile	0.0106
90% Chebyshev UPL	0.0136	95% Percentile	0.0113
95% Chebyshev UPL	0.0155	99% Percentile	0.0119
95% USL	0.012		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (compliance;bsl-2;arsenic;mg/l)

General Statistics

Total Number of Observations	20	Number of Distinct Observations	18
Minimum	0.00671	First Quartile	0.0106
Second Largest	0.0176	Median	0.0123
Maximum	0.0186	Third Quartile	0.0148
Mean	0.0125	SD	0.00326
Coefficient of Variation	0.261	Skewness	0.0611
Mean of logged Data	-4.419	SD of logged Data	0.276

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.396	d2max (for USL)	2.557

Normal GOF Test

Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.0939	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.0203	90% Percentile (z)	0.0166
95% UPL (t)	0.0182	95% Percentile (z)	0.0178
95% USL	0.0208	99% Percentile (z)	0.0201

Gamma GOF Test

A-D Test Statistic	0.209	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.101	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.194	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	14.6	k star (bias corrected MLE)	12.44
Theta hat (MLE)	8.5460E-4	Theta star (bias corrected MLE)	0.001
nu hat (MLE)	583.9	nu star (bias corrected)	497.6
MLE Mean (bias corrected)	0.0125	MLE Sd (bias corrected)	0.00354

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.019	90% Percentile	0.0172
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0192	95% Percentile	0.0188
95% WH Approx. Gamma UTL with 95% Coverage	0.0219	99% Percentile	0.0221
95% HW Approx. Gamma UTL with 95% Coverage	0.0222		
95% WH USL	0.0227	95% HW USL	0.0231

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.121	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.192	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.0233	90% Percentile (z)	0.0172
95% UPL (t)	0.0196	95% Percentile (z)	0.019
95% USL	0.0244	99% Percentile (z)	0.0229

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	20	95% UTL with 95% Coverage	0.0186
Approx, f used to compute achieved CC	1.053	Approximate Actual Confidence Coefficient achieved by UTL	0.642
		Approximate Sample Size needed to achieve specified CC	59

95% Percentile Bootstrap UTL with 95% Coverage	0.0186	95% BCA Bootstrap UTL with 95% Coverage	0.0186
95% UPL	0.0186	90% Percentile	0.0161
90% Chebyshev UPL	0.0225	95% Percentile	0.0177
95% Chebyshev UPL	0.027	99% Percentile	0.0184
95% USL	0.0186		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Result (compliance;bsl-3;arsenic;mg/l)

General Statistics

Total Number of Observations	20	Number of Distinct Observations	20
Minimum	0.0417	First Quartile	0.0527
Second Largest	0.0733	Median	0.0569
Maximum	0.0839	Third Quartile	0.0666
Mean	0.0595	SD	0.0105
Coefficient of Variation	0.176	Skewness	0.537
Mean of logged Data	-2.836	SD of logged Data	0.174

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.396	d2max (for USL)	2.557

Normal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.0846	90% Percentile (z)	0.0729
95% UPL (t)	0.0781	95% Percentile (z)	0.0767
95% USL	0.0863	99% Percentile (z)	0.0839

Gamma GOF Test

A-D Test Statistic	0.338	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.193	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	34.86	k star (bias corrected MLE)	29.67
Theta hat (MLE)	0.00171	Theta star (bias corrected MLE)	0.00201
nu hat (MLE)	1395	nu star (bias corrected)	1187
MLE Mean (bias corrected)	0.0595	MLE Sd (bias corrected)	0.0109

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0791	90% Percentile	0.0739
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0792	95% Percentile	0.0785
95% WH Approx. Gamma UTL with 95% Coverage	0.0871	99% Percentile	0.0878
95% HW Approx. Gamma UTL with 95% Coverage	0.0875		
95% WH USL	0.0893	95% HW USL	0.0898

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.144	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.192	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	0.0889	90% Percentile (z)	0.0733
95% UPL (t)	0.0798	95% Percentile (z)	0.078
95% USL	0.0914	99% Percentile (z)	0.0878

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	20	95% UTL with 95% Coverage	0.0839
Approx, f used to compute achieved CC	1.053	Approximate Actual Confidence Coefficient achieved by UTL	0.642
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.0839	95% BCA Bootstrap UTL with 95% Coverage	0.0839
95% UPL	0.0834	90% Percentile	0.0714
90% Chebyshev UPL	0.0917	95% Percentile	0.0738
95% Chebyshev UPL	0.106	99% Percentile	0.0819
95% USL	0.0839		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

```
                          Mann-Kendall Trend Test Analysis
         User Selected Options
   Date/Time of Computation   ProUCL 5.12/8/2022 8:35:36 PM
                  From File   qryJDW_ProUCL_Input_As_D2.xls
             Full Precision   OFF
     Confidence Coefficient   0.95
      Level of Significance   0.05

     Result-background;bg-1;arsenic;mg/l

              General Statistics
        Number of Events Reported (m)     10
             Number of Missing Events      0
        Number or Reported Events Used    10
           Number Values Reported (n)     10
                              Minimum     0.0231
                              Maximum     0.0476
                                 Mean     0.0333
                       Geometric Mean     0.032
                               Median     0.0328
                   Standard Deviation    0.00959
             Coefficient of Variation      0.288

             Mann-Kendall Test
                    M-K Test Value (S)    15
                     Tabulated p-value     0.108
                  Standard Deviation of S  11.18
                 Standardized Value of S    1.252
                     Approximate p-value    0.105

Insufficient evidence to identify a significant
 trend at the specified level of significance.
     Result-background;bg-2;arsenic;mg/l

              General Statistics
        Number of Events Reported (m)     10
             Number of Missing Events      0
        Number or Reported Events Used    10
           Number Values Reported (n)     10
                              Minimum    0.00688
                              Maximum     0.0206
                                 Mean     0.0118
                       Geometric Mean     0.0111
                               Median     0.0113
                   Standard Deviation    0.00448
             Coefficient of Variation      0.38

             Mann-Kendall Test
                    M-K Test Value (S)     7
                     Tabulated p-value     0.3
                  Standard Deviation of S  11.18
```

Standardized Value of S	0.537
Approximate p-value	0.296

Insufficient evidence to identify a significant trend at the specified level of significance.

Result-background;bsl-1;arsenic;mg/l

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	0.0072
Maximum	0.012
Mean	0.00927
Geometric Mean	0.00918
Median	0.00915
Standard Deviation	0.00137
Coefficient of Variation	0.148

Mann-Kendall Test

M-K Test Value (S)	1
Tabulated p-value	0.5
Standard Deviation of S	11.18
Standardized Value of S	0
Approximate p-value	0.5

Insufficient evidence to identify a significant trend at the specified level of significance.

Result-compliance;bsl-2;arsenic;mg/l

General Statistics

Number of Events Reported (m)	20
Number of Missing Events	0
Number or Reported Events Used	20
Number Values Reported (n)	20
Minimum	0.00671
Maximum	0.0186
Mean	0.0125
Geometric Mean	0.012
Median	0.0123
Standard Deviation	0.00326
Coefficient of Variation	0.261

Mann-Kendall Test

M-K Test Value (S)	17
Tabulated p-value	0.315
Standard Deviation of S	30.76
Standardized Value of S	0.52
Approximate p-value	0.301

Insufficient evidence to identify a significant trend at the specified level of significance.

Result-compliance;bsl-3;arsenic;mg/l

General Statistics

Number of Events Reported (m)	20
Number of Missing Events	0
Number or Reported Events Used	20
Number Values Reported (n)	20
Minimum	0.0417
Maximum	0.0839
Mean	0.0595
Geometric Mean	0.0587
Median	0.0569
Standard Deviation	0.0105
Coefficient of Variation	0.176

Mann-Kendall Test

M-K Test Value (S)	34
Tabulated p-value	0.144
Standard Deviation of S	30.82
Standardized Value of S	1.071
Approximate p-value	0.142

Insufficient evidence to identify a significant trend at the specified level of significance.

```
                              Theil-Sen Trend Test Analysis
           User Selected Options
    Date/Time of Computation   ProUCL 5.12/8/2022 8:37:13 PM
                   From File   qryJDW_ProUCL_Input_As_D2.xls
              Full Precision   OFF
          Average Replicates   Replicates at sampling events will be averaged!
      Confidence Coefficient   0.95
       Level of Significance   0.05

         Result-background;bg-1;arsenic;mg/l

                General Statistics
                           Number of Events     10
               Number of Values Reported (n)    10
             Number of Values After Averaging   10
                       Number of Replicates      0
                                    Minimum     0.0231
                                    Maximum     0.0476
                                       Mean     0.0333
                             Geometric Mean     0.032
                                     Median     0.0328
                         Standard Deviation    0.00959
                    Coefficient of Variation     0.288

              Mann-Kendall Statistics
                         M-K Test Value (S)     15
                          Tabulated p-value      0.108
                     Standard Deviation of S    11.18
                    Standardized Value of S      1.252
                        Approximate p-value      0.105

      Approximate inference for Theil-Sen Trend Test
                           Number of Slopes     45
                             Theil-Sen Slope   0.00125
                         Theil-Sen Intercept    0.0259
                                         M1     11.54
                                         M2     33.46
                    95% LCL of Slope (0.025)  -0.0025
                    95% UCL of Slope (0.975)   0.00334

   Insufficient evidence to identify a significant
    trend at the specified level of significance.

       Theil-Sen Trend Test Estimates and Residuals
         #  Events      Values    Estimates   Residuals
         1     1        0.0231     0.0271     -0.00403
         2     2        0.0418     0.0284       0.0134
         3     3        0.0236     0.0296     -0.00603
         4     4        0.0369     0.0309      0.00603
         5     5        0.0246     0.0321     -0.00753
         6     6        0.0394     0.0334      0.00603
```

7	7	0.0286	0.0346	-0.00603
8	8	0.0437	0.0359	0.00783
9	9	0.0235	0.0371	-0.0136
10	10	0.0476	0.0384	0.00923

Result-background;bg-2;arsenic;mg/l

General Statistics

Number of Events	10
Number of Values Reported (n)	10
Number of Values After Averaging	10
Number of Replicates	0
Minimum	0.00688
Maximum	0.0206
Mean	0.0118
Geometric Mean	0.0111
Median	0.0113
Standard Deviation	0.00448
Coefficient of Variation	0.38

Mann-Kendall Statistics

M-K Test Value (S)	7
Tabulated p-value	0.3
Standard Deviation of S	11.18
Standardized Value of S	0.537
Approximate p-value	0.296

Approximate inference for Theil-Sen Trend Test

Number of Slopes	45
Theil-Sen Slope	2.3000E-4
Theil-Sen Intercept	0.00999
M1	11.54
M2	33.46
95% LCL of Slope (0.025)	-0.00114
95% UCL of Slope (0.975)	0.00178

Insufficient evidence to identify a significant trend at the specified level of significance.

Theil-Sen Trend Test Estimates and Residuals

#	Events	Values	Estimates	Residuals
1	1	0.00688	0.0102	-0.00334
2	2	0.0164	0.0104	0.00596
3	3	0.0111	0.0107	4.2500E-4
4	4	0.014	0.0109	0.0031
5	5	0.00767	0.0111	-0.00347
6	6	0.0114	0.0114	3.5000E-5
7	7	0.00719	0.0116	-0.00441
8	8	0.0139	0.0118	0.00208
9	9	0.00872	0.0121	-0.00334
10	10	0.0206	0.0123	0.00832

Result-background;bsl-1;arsenic;mg/l

General Statistics

Number of Events	10
Number of Values Reported (n)	10
Number of Values After Averaging	10
Number of Replicates	0
Minimum	0.0072
Maximum	0.012
Mean	0.00927
Geometric Mean	0.00918
Median	0.00915
Standard Deviation	0.00137
Coefficient of Variation	0.148

Mann-Kendall Statistics

M-K Test Value (S)	1
Tabulated p-value	0.5
Standard Deviation of S	11.18
Standardized Value of S	0
Approximate p-value	0.5

Approximate inference for Theil-Sen Trend Test

Number of Slopes	45
Theil-Sen Slope	3.6250E-5
Theil-Sen Intercept	0.00895
M1	11.54
M2	33.46
95% LCL of Slope (0.025)	-4.255E-4
95% UCL of Slope (0.975)	4.1158E-4

Insufficient evidence to identify a significant trend at the specified level of significance.

Theil-Sen Trend Test Estimates and Residuals

#	Events	Values	Estimates	Residuals
1	1	0.00844	0.00898	-5.419E-4
2	2	0.00808	0.00902	-9.381E-4
3	3	0.0101	0.00905	0.00105
4	4	0.0072	0.00909	-0.00189
5	5	0.012	0.00913	0.00287
6	6	0.00981	0.00916	6.4687E-4
7	7	0.0104	0.0092	0.0012
8	8	0.00912	0.00924	-1.156E-4
9	9	0.00917	0.00927	-1.019E-4
10	10	0.00837	0.00931	-9.381E-4

Result-compliance;bsl-2;arsenic;mg/l

General Statistics

Number of Events	20
Number of Values Reported (n)	20
Number of Values After Averaging	20

```
                    Number of Replicates     0
                                 Minimum  0.00671
                                 Maximum   0.0186
                                    Mean   0.0125
                          Geometric Mean   0.012
                                  Median   0.0123
                      Standard Deviation  0.00326
                Coefficient of Variation   0.261

            Mann-Kendall Statistics
                      M-K Test Value (S)    17
                       Tabulated p-value   0.315
                   Standard Deviation of S  30.76
                  Standardized Value of S   0.52
                       Approximate p-value   0.301

     Approximate inference for Theil-Sen Trend Test
                        Number of Slopes   190
                         Theil-Sen Slope 1.0170E-4
                     Theil-Sen Intercept   0.0112
                                      M1   64.85
                                      M2  125.1
               95% LCL of Slope (0.025) -2.220E-4
               95% UCL of Slope (0.975) 5.0000E-4

Insufficient evidence to identify a significant
 trend at the specified level of significance.

     Theil-Sen Trend Test Estimates and Residuals
          #  Events      Values    Estimates   Residuals
          1     1        0.0141     0.0113      0.00277
          2     2        0.0176     0.0114      0.00616
          3     3        0.00956    0.0115     -0.00198
          4     4        0.0129     0.0116      0.00126
          5     5        0.0117     0.0117     -4.062E-5
          6     6        0.0149     0.0118      0.00306
          7     7        0.00671    0.0119     -0.00523
          8     8        0.00814    0.012      -0.00391
          9     9        0.00778    0.0121     -0.00437
         10    10        0.0186     0.0122      0.00635
         11    11        0.011      0.0124     -0.00135
         12    12        0.011      0.0125     -0.00145
         13    13        0.0114     0.0126     -0.00115
         14    14        0.0133     0.0127     6.4403E-4
         15    15        0.011      0.0128     -0.00176
         16    16        0.0138     0.0129     9.4062E-4
         17    17        0.0159     0.013       0.00294
         18    18        0.0148     0.0131      0.00174
         19    19        0.0157     0.0132      0.00254
         20    20        0.00959    0.0133     -0.00368
            Result-compliance;bsl-3;arsenic;mg/l
```

```
                General Statistics
                              Number of Events    20
                   Number of Values Reported (n)    20
                 Number of Values After Averaging    20
                          Number of Replicates     0
                                       Minimum    0.0417
                                       Maximum    0.0839
                                          Mean    0.0595
                                Geometric Mean    0.0587
                                        Median    0.0569
                            Standard Deviation    0.0105
                      Coefficient of Variation     0.176

              Mann-Kendall Statistics
                             M-K Test Value (S)    34
                              Tabulated p-value     0.144
                           Standard Deviation of S    30.82
                          Standardized Value of S     1.071
                             Approximate p-value     0.142

      Approximate inference for Theil-Sen Trend Test
                              Number of Slopes   190
                               Theil-Sen Slope 4.3000E-4
                           Theil-Sen Intercept    0.0523
                                            M1    64.79
                                            M2   125.2
                       95% LCL of Slope (0.025) -3.341E-4
                       95% UCL of Slope (0.975)   0.00133

Insufficient evidence to identify a significant
 trend at the specified level of significance.

      Theil-Sen Trend Test Estimates and Residuals
          #   Events       Values      Estimates   Residuals
          1     1           0.0463       0.0528    -0.00647
          2     2           0.0497       0.0532    -0.0035
          3     3           0.0733       0.0536      0.0197
          4     4           0.0642       0.0541      0.0101
          5     5           0.0516       0.0545    -0.00289
          6     6           0.0589       0.0549     0.00399
          7     7           0.066        0.0553      0.0107
          8     8           0.0528       0.0558    -0.00298
          9     9           0.055        0.0562    -0.00121
         10    10           0.0538       0.0566    -0.00284
         11    11           0.0587       0.0571     0.00164
         12    12           0.0417       0.0575     -0.0158
         13    13           0.0542       0.0579    -0.00373
         14    14           0.0712       0.0584      0.0128
         15    15           0.0839       0.0588      0.0251
         16    16           0.0685       0.0592     0.00929
```

17	17	0.0529	0.0596	-0.00675
18	18	0.0645	0.0601	0.00443
19	19	0.0705	0.0605	0.00999
20	20	0.0524	0.0609	-0.00854

```
                              Classical Oneway ANOVA
   Date/Time of Computation   ProUCL 5.12/10/2022 8:37:33 PM
                  From File   BS_ProUCL_Input_ANOVA_20220210.xls
             Full Precision   OFF



                   Result


                             Group  Obs        Mean        SD          Variance
            bsl-1;arsenic;mg/l;pre   11        0.00664     9.2333E-4   8.5255E-7
           bsl-1;arsenic;mg/l;post   10        0.00927       0.00137   1.8825E-6
         Grand Statistics (All data)  21        0.00789       0.00176   3.0886E-6


                Classical One-Way Analysis of Variance Table
               Source    SS          DOF       MS          V.R.(F Stat)  P-Value
       Between Groups    3.6304E-5     1       3.6304E-5      27.08      5.0485E-5
        Within Groups    2.5468E-5    19       1.3404E-6
                Total    6.1772E-5    20


   Pooled Standard Deviation     0.00116
                        R-Sq       0.588
```

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in
mean/median characteristics of the various groups at 0.05 or other selected level of significance
A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparable.

```
                           Nonparametric Oneway ANOVA (Kruskal-Wallis Test)
        Date/Time of Computation   ProUCL 5.12/10/2022 8:38:24 PM
                       From File   BS_ProUCL_Input_ANOVA_20220210.xls
                  Full Precision   OFF



                 Result


             Group           Obs      Median     Ave Rank      Z
bsl-1;arsenic;mg/l;post      10        0.00915     16          3.521
 bsl-1;arsenic;mg/l;pre      11        0.0064       6.455     -3.521
                Overall      21        0.0077      11

           K-W (H-Stat)    DOF      P-Value   (Approx. Chisquare)
                  12.4       1    4.3009E-4
                  12.4       1    4.2824E-4      (Adjusted for Ties)

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in
mean/median characteristics of the various groups at 0.05 or other selected level of significance
A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparabl
```

```
                                   Classical Oneway ANOVA
          Date/Time of Computation ProUCL 5.12/10/2022 8:39:03 PM
                         From File BS_ProUCL_Input_ANOVA_20220210_a.xls
                    Full Precision OFF



                   Result

                         Group Obs          Mean        SD          Variance
           bsl-2;arsenic;mg/l;pre    32            0.0185     0.00814   6.6322E-5
          bsl-2;arsenic;mg/l;post    20            0.0125     0.00326   1.0612E-5
       Grand Statistics (All data)   52            0.0162     0.00727   5.2894E-5

                  Classical One-Way Analysis of Variance Table
               Source     SS          DOF         MS        V.R.(F Stat)  P-Value
       Between Groups  4.4000E-4       1        4.4000E-4     9.745       0.00299
        Within Groups    0.00226      50        4.5152E-5
                Total    0.0027       51

        Pooled Standard Deviation      0.00672
                             R-Sq        0.163

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in
mean/median characteristics of the various groups at 0.05 or other selected level of significance
A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparable.
```

Nonparametric Oneway ANOVA (Kruskal-Wallis Test)

Date/Time of Computation	ProUCL 5.12/10/2022 8:39:38 PM
From File	BS_ProUCL_Input_ANOVA_20220210_a.xls
Full Precision	OFF

Result

Group	Obs	Median	Ave Rank	Z
bsl-2;arsenic;mg/l;post	20	0.0123	19.48	-2.643
bsl-2;arsenic;mg/l;pre	32	0.019	30.89	2.643
Overall	52	0.0145	26.5	

K-W (H-Stat)	DOF	P-Value	(Approx. Chisquare)
6.984	1	0.00823	
6.992	1	0.00819	(Adjusted for Ties)

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in mean/median characteristics of the various groups at 0.05 or other selected level of significance

A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparabl

```
                                   Classical Oneway ANOVA
         Date/Time of Computation  ProUCL 5.12/10/2022 8:40:19 PM
                        From File  BS_ProUCL_Input_ANOVA_20220210_b.xls
                   Full Precision  OFF



                 Result


                            Group  Obs          Mean       SD         Variance
           bsl-3;arsenic;mg/l;pre    33           0.0539     0.0125   1.5687E-4
          bsl-3;arsenic;mg/l;post    20           0.0595     0.0105   1.0970E-4
       Grand Statistics (All data)   53           0.056      0.012    1.4404E-4


                Classical One-Way Analysis of Variance Table
              Source    SS           DOF        MS          V.R.(F Stat)  P-Value
      Between Groups  3.8574E-4       1      3.8574E-4        2.769        0.102
       Within Groups    0.0071       51      1.3930E-4
               Total    0.00749      52


     Pooled Standard Deviation    0.0118
                          R-Sq    0.0515

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in
mean/median characteristics of the various groups at 0.05 or other selected level of significance
A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparable.
```

Nonparametric Oneway ANOVA (Kruskal-Wallis Test)

Date/Time of Computation	ProUCL 5.12/10/2022 8:40:38 PM
From File	BS_ProUCL_Input_ANOVA_20220210_b.xls
Full Precision	OFF

Result

Group	Obs	Median	Ave Rank	Z
bsl-3;arsenic;mg/l;post	20	0.0569	31.95	1.817
bsl-3;arsenic;mg/l;pre	33	0.052	24	-1.817
Overall	53	0.053	27	

K-W (H-Stat)	DOF	P-Value	(Approx. Chisquare)
3.3	1	0.0693	
3.302	1	0.0692	(Adjusted for Ties)

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in

mean/median characteristics of the various groups at 0.05 or other selected level of significance

A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparabl