GUAM SOLID WASTE AUTHORITY

LOURDES A. LEON GUERRERO
Governor of Guam

JOSHUA F. TENORIO
Lt. Governor of Guam

IRVIN SLIKE
General Manager

November 22, 2022

REQUEST FOR PROPOSALS
GSWA-RFP002-22
LANDFILL COMPLIANCE AND ENGINEERING CONSULTING SERVICES

AMENDMENT NO. 3

ANSWERS TO WRITTEN QUESTIONS SUBMITTED BY POTENTIAL OFFERORS ARE LISTED BELOW WITH GSWA'S RESPONSE.

The RFP documents of the above project are hereby amended as follows:

Question 1. The RFP gives instructions on submitted forms with "ink" signatures. Though we have an office on the island, our corporate officers who need to sign the required forms are located in Hunt Valley, Maryland. Is it acceptable for forms to be submitted with scanned copies?

Response: Proposal may be submitted with scanned copies.

Question 2. With the extension of the RFP due date by one month, is the deadline to ask questions extended as well?

Response: Refer to Amendment No. 2

Question 3. Can GSWA share the existing monitoring plan for the landfill?

Response: Please see existing Detection Monitoring Program (Attachment AD2-A1) and Leachate Quality Monitoring plan (Attachment AD2-A2) attached.

Question 4. Can GSWA provide any recent monitoring data for the landfill?

Response: Please see most recent Water Quality Monitoring Report (Attachment AD2-B) attached.

Irvin L. Slike
General Manager

ACKNOWLEDGEMENT RECEIPT
Return to GSWA by email or fax.

Received By: _____

Date: _____

Company Name: _____

Fax to: 671-649-3777
Email: procurement@gswa.guam.gov

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EA Engineering, Science, and Technology, Inc., PBC

15 September 2022

Mr. Irvin Slike
General Manager
Guam Solid Waste Authority
542 North Marine Corps Drive
Tumon, Guam 96913

RE: Proposal for Detection Monitoring Program Rounds 23 and 24 at Layon Municipal Solid Waste Landfill, Inarajan, Guam

Dear Mr. Slike,

EA Engineering, Science, and Technology, Inc., PBC (EA) is pleased to resubmit this proposal for implementation of the Detection Monitoring Program (DMP) Rounds 23 and 24, for the Layon Landfill in Inarajan, Guam. The work will be performed in accordance with the current permit to operate the Municipal Solid Waste Landfill and in accordance with applicable federal and territorial solid waste regulations and permit conditions. The DMP involves the collection and analysis of surface water and groundwater samples from point-of-compliance sample locations. In addition, this proposal addresses landfill gas, subdrain water monitoring, and stormwater benchmark monitoring at the landfill. The results of the sampling events will be submitted to the Guam Solid Waste Authority (GSWA) and Guam Environmental Protection Agency (Guam EPA). Sampling results for stormwater compliance will be submitted by the operator to the USEPA. All field work and analyses will be conducted in accordance with the DMP, and the 2010 Specific Water Quality Monitoring Plan Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP).

Task 1: Meetings

EA will support GSWA when meeting with Guam EPA to discuss the status of the project and the results of the reports submitted to the stakeholders, if needed. In addition, EA will meet with GSWA and Guam EPA if a potential change in site status requires notification to the Administrative Record, that may be necessary due to the opening of the new Cell 3 and future modifications to the monitoring well network during 2022-2023. EA participants may include the Project Manager (PM), Senior Technical Reviewer, and Senior Chemist.

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Task 2: Surface Water/Groundwater Sample Collection

EA will collect two rounds of groundwater and surface water samples from the point-of-compliance locations identified in the DMP. The point-of-compliance locations are groundwater monitoring wells:

- MW-14A
- MW-25A
- MW-26A
- MW-27A
- MW-28A
- MW-29A
- MW-30
- MW-31
- MW-32

Note: Monitoring well MW-16A was abandoned during July 2020 as the well was within the footprint of Cell No. 3. The surface water sampling locations are:

- SW-1
- SW-2

The groundwater and surface water samples will be collected during November 2022 and May 2023, during the wet and dry seasons, respectively. Samples will be collected and analyzed in accordance with the DMP, QAPP and SAP. Water samples will be analyzed for constituents listed in Appendix I of Title 22, Division 4, Chapter 23, Article 5 Guam Solid Waste Disposal Rules and Regulations. These constituents include inorganic and volatile organic compounds (VOCs). Water samples will also be collected and analyzed for the inorganic constituents to include:

- Alkalinity (total, bicarbonate, carbonate, and hydroxide)
- Other major anions (bromide, chloride, fluoride, and sulfate)
- Major cations (calcium, magnesium, potassium, and sodium)
- Minor cations (aluminum, iron, manganese, and strontium)
- Ammonia
- Boron
- Silicon
- Total sulfide
- Total cyanide
- Total phosphorus
- Chemical oxygen demand (COD)

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- Nitrate plus nitrite
- Total organic carbon (TOC)
- Total dissolved solids (TDS)
- Total suspended solids (TSS)

Samples will be collected and analyzed in accordance with the DMP, QAPP, and SAP. Water samples will be analyzed for constituents listed in Appendix I of Title 22, Division 4, Chapter 23, Article 5 Guam Solid Waste Disposal Rules and Regulations. These baseline constituents include VOCs, semivolatile organic compounds, organophosphorus compounds, polychlorinated biphenyls, organochlorine pesticides to include herbicides, and metals. Water samples will also be collected and analyzed for the inorganic constituents bulleted list mentioned above.

During the groundwater sampling events, depth to groundwater will be measured manually at each well sampled, and a complete round of water level measurements will be collected from all groundwater monitoring wells at the landfill to prepare a groundwater elevation map. The groundwater elevation map calculated hydraulic gradient, and groundwater velocity will be included in the monitoring report. In accordance with Article 5, Section 23502, the monitoring wells will be inspected as part of the groundwater sampling event. The wells will be inspected for items of deficiency that may affect the integrity of the well and its function to allow collection of groundwater samples. The streams associated with surface water sample locations SW-1 and SW-2 will be inspected for general water conditions (flowing water, water depth, odor, foam, etc.).

Assumptions:

- Two rounds of water samples will be collected from nine (9) groundwater monitoring wells and two (2) surface water monitoring locations.
- Groundwater monitoring wells MW-14A, MW-25A, MW-26A, MW-27A, MW-28 MW-29A, MW-30, MW-31, and MW-32 as well as surface water locations SW-1 and SW-2 are anticipated to be sampled during November 2022 and May 2023.
- All samples will be sent to the same laboratory for analysis. EA anticipates using SGS North America Inc. in Orlando, Florida to analyze the groundwater and surface water samples.
- Quality assurance/quality control samples including blind field duplicates, trip blanks and matrix spike/matrix spike duplicates (if applicable) will be analyzed (surface water and groundwater). One (1) blind duplicate sample will be collected for groundwater or for surface water during each event. Two (2) trip blanks will be analyzed for VOCs for each event.
- All samples collected under this task will be analyzed using the standard laboratory turn-around time (10 working days from receipt).

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- Depth-to-water measurements will be collected manually from the existing wells during the sampling event.
- Travel time is anticipated to be a two (2)-hour round trip each day.
- Groundwater is considered non-hazardous and purged water will be discharged directly to the ground in the vicinity of the wells.
- Field personnel will work in Level D protective clothing while performing field activities.

Task 3 – Landfill Gas Monitoring

Landfill gas will be monitored at the three (3) landfill gas monitoring wells (LGP-1M, LGP-2M and LGP-3M) installed along the perimeter of Cells 1, 2, and 3. Each well will be monitored for the lower explosive limit for methane gas and total VOCs (methane) concentrations. A Landtec GEM™ gas analyzer will be used to monitor the concentration of methane gas within each of the gas monitoring wells. The gas monitoring results will be recorded on data forms and will be submitted to GSWA. If any gas concentration exceeds the lower explosive limit (5 percent by volume for methane), GSWA and Guam EPA will be notified so that additional evaluation can occur and precautions to protect human health and the environment can be implemented, if necessary. Notice of a non-compliance event shall be submitted by GSWA to Guam EPA as required by the facility Operation Plan Permit.

Assumptions:

- Landfill gas results will be collected quarterly for four quarters during the task order period.
- Landfill gas results will be recorded on data forms and submitted to GSWA.
- Landfill gas results will also be submitted for the Administrative Record.
- The Landtec GEM™ gas analyzer will be utilized to monitor the concentration of VOCs (methane).
- The Landtec GEM™ gas analyzer will be calibrated to methane standards prior to the sampling event.
- Report format will be coordinated with GSWA to ensure compatibility with permit- required formats under the Air Permit requirements.
- Travel time is anticipated to be a two (2)-hour round trip each day.

Task 4 – Subdrain Monitoring

The subdrain system continuously collects groundwater beneath the liner, and frequently discharges water from the subdrain tank as a part of facility operations. The discharge of the subdrain tank water requires visual field assessment, or inspection, prior to and during each tank discharge. This work will be accomplished in accordance with the *Stormwater Pollution Prevention Plan* for the facility (EA, 2015). The visual field assessment procedure is adopted from the National Pollutant Discharge

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Elimination System (NPDES) permit for stormwater discharges at industrial sites. Water in the subdrain tank will be visually inspected at the time of sample collection for evidence of contamination associated with leachate. EA personnel will inspect the subdrain tank water when the tank is half full.

If leachate has been identified in the secondary Leachate Collection and Removal System (LCRS) or if the visual inspection of subdrain tank water indicates that leachate may be present, a water sample from the subdrain tank will be collected and analyzed for the same parameters as leachate (Appendix I of Title 22, Division 4, Chapter 23, Article 5 Guam Solid Waste Disposal Rules and Regulations). If the results exceed background concentrations for leachate parameters, batch monitoring for the subdrain tank will be implemented. In accordance with the *Subdrain Monitoring and Discharge Release Plan*, batch monitoring will be conducted monthly. EA proposes to collect up to five subdrain tank samples for this task when the subdrain tank is half full. Subdrain tank water samples will be analyzed for total alkalinity, biological oxygen demand (BOD), carbonaceous biochemical oxygen demand (cBOD), ammonia as nitrogen, chloride, COD, TKN, TSS, and general water quality parameters for leachate. The water will be stored in the subdrain tank pending the analytical results.

Assumptions:

- This proposal assumes that no more than five subdrain tank samples will be collected when the subdrain tank is half full.
- The turn-around time for the analytical laboratory will be five (5) working days from receipt at the laboratory. The laboratory analytical cost for a five (5)-day turn-around time is 30% greater than the standard 10-day turnaround time.
- The analytical method holding time for BOD and cBOD analyses is 48 hours from time of sample collection until analysis. Hawaii Food & Water Test LLC (HFWT) located in Honolulu, Hawaii will analyze the water samples for BOD and cBOD to meet the analytical method holding times, to comply with the QAPP and Federal regulations. SGS North America Inc. located in Orlando, Florida will analyze the remainder of the analytes.
- A courier service will be utilized to transport BOD and cBOD samples from the Honolulu airport to HFWT laboratory.
- A field technician will need to inspect subdrain liquids monthly and collect samples if batch monitoring is required. A cost modification will be required for the Task Order if batch monitoring is required.
- All field equipment will be calibrated prior to each sample event.
- Travel time is anticipated to be a two (2)-hour round trip each day.

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Task 5 – Stormwater Pollution Prevention Monitoring

In accordance with the 2015 Layon Landfill Stormwater Pollution Prevention Plan (SWPPP), EA will collect four (4) quarterly benchmark grab samples at all five outfalls during significant rain events between 1 October 2021 until 30 September 2022. The SWPPP identified five (5) monitoring points at the site. The five monitoring points (Outfalls) listed in the SWPPP are:

- Outfall 1 – Active Cells 1 & 2 via Pond 3A
- Outfall 2 – Cover Soil Piles and Cell 3 via Pond 2
- Outfall 3 – Maintenance Shop/Parking Area
- Outfall 4 – Administrative Building Parking Area/Equipment Wash Rack
- Outfall 5 – Water Tank/Generator Building/Driveway.

The samples will be analyzed for the following parameters:

- TSS
- pH
- COD

Sample results will be compared to the established Sector-Specific Benchmark limits as defined in the SWPPP and the Multi-Sector General Permit (MSGP) Section 8.L.9, Table 8.L. Benchmark monitoring is required only for discharges not subject to effluent limitations in 40 CFR Part 445 Subpart B.

The MSGP Section 8.L.10 states that monitoring annually (set forth at 40 CFR Part 445 Subpart B), numeric effluent limitations apply to contaminated stormwater discharges from a Municipal Solid Waste Landfill Facility that have not been closed is in accordance with 40 CFR 258.60. If stormwater is determined to be contaminated annual monitoring will be performed and is not included in this cost estimate. Contaminated stormwater is stormwater that comes into direct contact with landfill wastes, the waste handling and treatment areas, or landfill wastewater as defined in the MSGP Part 8.K.4.4. Some specific areas of a landfill that may produce contaminated stormwater include (but are not limited to) the open face of an active landfill with exposed waste (no cover added); the areas around wastewater treatment operations; trucks, equipment, or machinery that has been in direct contact with the waste; and waste dumping areas.

Assumptions:

- Samples will only be collected during a significant rain event during the task order period.
- Four quarterly benchmark samples will be collected and analyzed for TSS only at all five outfalls during significant rain events occurring during the task order period.
- SGS North America Inc. in Orlando, Florida will analyze the water samples.
- Samples will be collected by an experienced field technician.
- Effluent limit monitoring is not included in this cost estimate. A cost modification will be required for the Task Order if annual monitoring is required.

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- Travel time is anticipated to be a two (2)-hour round trip each day.

Task 6 – Report Preparation

One draft and final detection monitoring report will be prepared and submitted. Senior and Mid-Scientist (Chemists) will conduct data validation for all data collected. Validation includes a review of data for accuracy, precision, representativeness, completeness, and comparability in accordance with the QAPP. The report information will satisfy requirements within the DMP.

Minimally, the report will include:

- A groundwater elevation map,
- Groundwater velocity calculation with direction of groundwater flow calculation,
- Analytical results,
- Notes on well conditions,
- Surface water observations, and
- Statistical evaluation of data and conclusions.

Assumptions:

- Draft and final copies of the report will be submitted for review and approval
- The detection monitoring report will be prepared and submitted to the agencies 90 days after the final day of each sampling event (anticipated to be February 2023 (Round 21) and August 2023 (Round 22).
- Senior and Mid Scientist (Chemists) will conduct data validation for all data collected.
- The analytical results will be maintained and stored by EA for a minimum period of five years from the end of the project.
- An Access™-based database will be used to maintain and store the analytical results. The database will be submitted to GSWA at the end of the project.
- Report format will be coordinated with GSWA to ensure compatibility with permit required formats under the NPDES, Air Permit and Solid Waste Permits.

Task 7 – Project Management

EA will provide project management. This effort includes the management of the task progress and budget, and coordination with GSWA and Guam EPA. The project management task also includes contracting and managing subcontractors. EA will prepare details of correspondence, progress reports, and monthly invoices for GSWA.

Assumptions:

- The project will be awarded under the existing Technical Service Agreement between EA and GSWA.

EA Engineering, Science, and Technology, Inc., PBC

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- The project is subject to Guam Gross Receipt Tax, and the tax amount is [redacted]
- In order to ensure that there is no interruption in service for the proposed monitoring activities, the executed contract must be received no later than [redacted]

EA anticipates completing the above-referenced tasks under the *lump sum* contract amount of [redacted] The attached cost table and sample parameter table present the labor and other direct costs for this task based on EA FY23 rates.

If there are any questions regarding this letter proposal, or if additional information is required, please contact me at (671) 646-5231 or wjanasak@eaest.com. We appreciate the opportunity to continue our professional relationship with GSWA.

Sincerely,

Billy Janasak
Project Manager

Attachments:
Attachment A. Cost Proposal to the Guam Solid Waste Authority for Detection Monitoring Program Rounds 23 and 24 at Layon Municipal Solid Waste Landfill

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EA Engineering, Science, and Technology, Inc., PBC

13 October 2022

Mr. Irvin Slike
General Manager
Guam Solid Waste Authority
542 North Marine Corps Drive
Tamuning, Guam 96913

RE: Proposal for Leachate Quality Monitoring at the Layon Municipal Solid Waste Landfill, Inarajan, Guam 2022-2023

Dear Mr. Slike:

EA Engineering, Science, and Technology, Inc., PBC (EA) is pleased to submit this letter proposal for continuing Water Quality Leachate Monitoring at the Layon Municipal Solid Waste Landfill, Inarajan, Guam. The Water Quality Monitoring project involves the collection and analysis of leachate at the Layon Landfill and flow measurement collection at the Inarajan booster pump station. Leachate samples will be collected twice per month for a 12-month period that will start 1 October 2022. The results of the sampling events will be evaluated, and the report will be submitted to the Guam Solid Waste Authority (GSWA) and Guam Environmental Protection Agency (EPA) on a quarterly basis. The work will be conducted in accordance with the applicable federal and Guam regulations.

Task 1: Sample Collection

EA will collect leachate samples from the leachate holding tank at Layon Landfill. Samples will be collected and analyzed in accordance with the existing Quality Assurance Project Plan (QAPP) and Sampling Plan. The field data will be documented on field data sheets, which will be completed during each sampling event. In accordance with 40 Code of Federal Regulations (CFR) Part 136 and Guam water codes, leachate will be analyzed for: 5-day biological oxygen demand (BOD), carbonaceous biological oxygen demand (cBOD), chemical oxygen demand (COD), Total Kjeldahl Nitrogen (TKN), ammonia, total suspended solids (TSS), alkalinity, dissolved oxygen (DO), pH, specific conductivity, chloride, and priority pollutants excluding 2,3,7,8-tetrachloro- p-dioxin (TCDD), asbestos, and hexavalent chromium. The following parameters will be measured in the field using a water quality instrument:

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EA Engineering, Science, and Technology, Inc., PBC

- DO
- pH
- salinity
- specific conductivity
- temperature
- turbidity

Assumptions:

- Leachate samples will be collected from the leachate tank at Layon Landfill from the period of 1 October 2022 through 30 September 2023 (12 months). Leachate samples will be collected twice per month for the analytes listed in the QAPP.
- Samples for priority pollutant analyses will be collected once per year.
- Quality assurance/quality control samples will be collected once per year for all sample parameters excluding priority pollutants. QA/QC samples include blind field duplicates and matrix spike/matrix spike duplicates.
- Round trip for travel is two hours to travel from the office to Layon Landfill and the Inarajan Sewage Lift Station. Two hours are required to collect leachate samples.
- Field instruments will be calibrated prior to each sampling event as stated in the QAPP.
- The analytical method holding time for BOD and cBOD analyses is 48 hours from time of sample collection until analysis. HWFT laboratory in Oahu, Hawaii will analyze the water samples for BOD and cBOD to meet the analytical method holding times, to comply with the QAPP and Federal regulations. SGS laboratories will analyze the water samples for the remaining parameters.
- A courier service will be utilized to transport BOD and cBOD samples from the Honolulu airport to HWFT laboratory.
- It is assumed that Guam Waterworks Authority (GWA) will provide access to the Inarajan Sewage Lift Station Building to allow EA personnel to record influent flow rates twice per month.

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Task 2 – Database Management

The field data will be entered into the project database. The laboratory reports summarizing analytical results and QC results will be provided to the Data Management Coordinator in hard copy and electronic formats. The laboratory results will be entered into the database for the purpose of storing results and to verify the data for quality assurance. The information in the database will be utilized to generate data tables for the quarterly reports.

Assumptions:

- The analytical results will be maintained and stored by EA for a minimum period of five years from the end of the project.
- An Access™-based database will be used to maintain and store the analytical results.
- Senior and Mid-Scientists (Chemists) will conduct data validation for all data collected. Validation includes a review of data for accuracy, precision, representativeness, completeness, and comparability in accordance with the QAPP prepared for this project.
- Electronic laboratory data will be uploaded into the Access database. Field sampling parameters such as DO, temperature, turbidity, and salinity will be transferred from field data sheets into the database by EA personnel. Chain of Custody documentation will also be uploaded by the Database Administrator.

Task 3 – Report Preparation

EA will submit a technical memorandum that will be prepared quarterly. EA will also review leachate flow rates at Layon Landfill and influent flow rates at the Inarajan sewage lift station near. The technical memorandum will have a narrative analysis of the monthly leachate data. The memorandum will include a comparison of leachate flows at the Layon Landfill to flow numbers collected at the Inarajan Sewage Lift Station. A comparison of leachate constituent data for the period to historical data will be performed. A final version of the technical memorandum will be submitted to GSWA, GWA, and Guam EPA.

Assumptions:

- The technical memorandums will be prepared quarterly.
- EA will prepare quarterly (four quarters) draft and final electronic versions of the document.
- Client will submit the final electronic version of the document to the stake holders.
- Layon Landfill operator will provide the subcontractor with leachate flow rate and rainfall data each month.

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Task 4 – Project Management

EA will provide project management for the duration of the project. This effort includes the weekly management of the task progress and budget, and coordination with GSWA, GWA, and Guam EPA. The project management task also includes contracting and managing subcontractors. EA will prepare meeting minutes (as necessary), details of correspondence, and monthly progress reports and invoices for GSWA.

Assumptions:

- The project will be awarded under the existing Technical Service Agreement between EA and GSWA.
- The project is subject to Guam Gross Receipt Tax and the tax amount is [redacted].
- In order to ensure that there is no interruption in service for the proposed monitoring activities, the executed contract must be received no later than [redacted].

Task 5 – Review of Leachate Sampling and Disposal Requirements

EA will review the historical leachate sampling and analysis data, the current leachate sampling frequency, and conduct a statistical trend analysis using the univariate Mann-Kendall test to determine if the leachate concentrations are stable, increasing, or decreasing at the 95% confidence level. EA will then present in a letter a recommendation as to what sampling frequency and which analytes should be required by GWA in the future for leachate discharge into the sewer system from Layon Landfill.

Assumption(s):

- Layon Landfill remains a municipal solid waste landfill. No hazardous waste is disposed of at this landfill.
- EA will submit draft and final document and will respond to one round of comments from the GSWA/Guam Waterworks Authority.

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EA Engineering, Science, and Technology, Inc., PBC

EA anticipates completing the above-referenced tasks under the *lump sum* contract amount of [redacted]. The period of performance for the proposed scope of work and cost is 12 months. The attached cost table and sample parameter table present the labor and other direct costs for this task based on EA FY23 rates.

If there are any questions regarding this letter proposal, or if additional information is required, please contact me at (670) 646-5231 or wjanasak@eaest.com.We appreciate the opportunity to continue our professional relationship with GSWA.

Sincerely,

Billy Janasak
Project Manager

Attachments
Attachment A - Cost Proposal to GSWA for Water Quality Leachate Monitoring at the Layon Municipal Solid Waste Landfill

Technical Memorandum No. 46

Subject: **Water Quality Monitoring Report**
June 2022 through August 2022

Date: **November 4, 2022**

Prepared for: **Guam Solid Waste Authority**

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Tables

Figures

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1. Introduction and Background

This technical memorandum summarizes the 4th quarter of the 11th operational year monitoring program for the Layon Landfill leachate and presents flow and quality data collected from June through August 2022.

The leachate from the Layon Landfill is treated at Guam Waterworks Authority's (GWA) Inarajan Wastewater Treatment Plant (WWTP). A leachate treatment and feasibility study to assess the capacity of the WWTP to treat the leachate was part of the landfill design effort in 2009. This study was conducted under contract to Gershman, Brickner, & Bratton, Inc. (GBB), the Receiver of the Guam Solid Waste Authority (GSWA). A report entitled *Layon Landfill Leachate Treatment Feasibility Study* was prepared in September 2009 (Brown and Caldwell, 2009). The Guam Environmental Protection Agency (GEPA), the United States Environmental Protection Agency (USEPA), and GWA accepted this report and its recommended monitoring program.

The monitoring program includes sampling and analysis to assess the impact of leachate on the performance of the Inarajan WWTP, and the possible impact of the Inarajan WWTP effluent reaching marine waters. Although the Inarajan WWTP discharges its effluent into percolation beds and is considered to be a non-discharging facility, possible preferential groundwater pathways were observed at two locations along the shoreline, so the program was initially developed to include the sampling of near-shore marine waters. Marine water quality sampling ended in 2018 after more than five years of monitoring at the request of the Solid Waste Receiver, with the last samples collected on April 17, 2018; note that the Quality Assurance Project Plan (Brown and Caldwell, 2011) specified three years of monitoring. The marine water quality monitoring was discontinued because the data did not show significant differences between the results at the two control stations and the results at the stations where two preferential groundwater discharge areas were identified in a dye trace study. Marine water quality data will not be discussed in future quarterly technical memoranda unless the sampling and analysis of marine water quality is resumed.

The sampling and analysis for this program are performed in accordance with a Quality Assurance Project Plan (Brown and Caldwell, 2011) reviewed by the GEPA and the USEPA.

The Treatment Feasibility Study (Brown and Caldwell, 2009) identified four triggers that, if met, would possibly warrant improvements to the Inarajan WWTP. The triggers were not intended to be absolute in their implementation. The actual performance of the Inarajan WWTP is assessed in conjunction with the triggers. These triggers are listed below.

1. Inarajan WWTP effluent shows depressed pH (less than 6.8 standard units) or effluent ammonia is greater than 10 milligrams per liter (mg/L).
2. Actual average day or peak day leachate flow is greater than 30 percent of Inarajan WWTP influent flow.
3. Leachate flow or load reaches 50 percent of the total influent flow or load that would be inhibitory to biological activity, based on future batch treatability studies.
4. Water quality standards are exceeded during sampling events. The action will depend on the water quality standard that is exceeded.

There were two planned phases to the sampling and analysis program: pre-leachate discharge and post-leachate discharge. The pre-leachate discharge phase focused on characterizing the influent and effluent of the Inarajan WWTP prior to leachate discharge. The pre-leachate discharge phase began in February 2011 and ended in August 2011. The post-leachate discharge phase focused on assessing the impact of leachate on the Inarajan WWTP. This post-leachate discharge phase began on September 1, 2011 and ended in September 2013.

The Layon Landfill began accepting waste on a full-time basis on September 1, 2011. A small quantity of leachate was discharged to the WWTP on September 2, 2011. The first significant discharge of leachate – approximately 31,380 gallons – occurred on September 3, 2011. During the first three-month period of landfill operations, the leachate discharge was adjusted over time to reduce peak discharges and to equalize the flow to the WWTP once the system began to operate consistently (Brown and Caldwell, 2013).

A monitoring program was planned for six years following the September 2013, post-leachate phase of the sampling and analysis program. This continuing program covers the 3rd through 8th operational years from September 1, 2013 through August 31, 2019, and subsequent years as required. GSWA is continuing the sampling and analysis program during the 11th operational year.

GWA conducts the routine monitoring of the Inarajan WWTP influent and effluent as a normal operational practice so that an assessment of the impact of landfill leachate on the WWTP may be performed. GWA began reporting Inarajan WWTP effluent total suspended solids (TSS) in March 2015. Effluent TSS values were reported for each month of this quarter. These additional TSS data alone are insufficient, however, to assess the impact of leachate on the performance of the WWTP, as landfill leachate typically has low TSS concentrations. The WWTP's effluent TSS may be influenced by conditions other than the leachate itself, including solids loss due to accumulated sludge in the treatment cells, and algal growth in the supernatant of the cells.

GWA also monitors WWTP influent pH daily. The minimum daily influent pH for the quarter (June 2022 through August 2022) was 7.25 pH standard units, which is higher than the WWTP effluent 6.8 pH trigger discussed previously in this section.

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2. Layon Landfill Data

Layon Landfill data consist of leachate flow and quality analytical results. The purpose of these data sets is to determine the possible impact of leachate on the Inarajan WWTP. As stated in the previous section, the only WWTP effluent quality data available to evaluate the impact of leachate on the WWTP are readings of the daily effluent pH as well as TSS for June 2022, July 2022, and August 2022, which are insufficient to determine the impact of leachate on the WWTP's performance. Consequently, this section assesses leachate flow and water quality data in relation to the triggers discussed previously, and with regard to the observable trends in the data.

2.1. Flow Data

Flow meter readings for leachate flows and Inarajan WWTP influent flows are recorded daily. GWA calculates and reports Inarajan WWTP influent flows in monthly operating reports. Green Group Holdings - Guam, LLC (GGH), the Layon Landfill operator, records leachate flow daily, except Sundays, most holidays, and days when time does not permit and reports the data monthly. Leachate flows are calculated from flow meter readings on the landfill's primary and secondary sump pump discharges. The sump pumps discharge to a 15,000-gallon leachate storage tank. Pump Station 1 conveys the leachate from the storage tank into the conveyance system. Pump Station 1 is the first in a series of four pump stations that convey leachate to the Inarajan WWTP. The first two pump stations (Stations 1 and 2) in the conveyance system are on the landfill property and are operated and maintained by GGH. The second two pump stations (GWA Stations 31 and 32) are located off the landfill property and are operated and maintained by GWA. The leachate and WWTP influent flows reported for this quarter are presented in Attachment A.

In June 2014, GWA began recording and reporting leachate flow from the GWA system flow meter located outside the gate of the landfill. The flow meter is located at the entrance gate of the Layon Landfill, downstream of Pump Station 2 in the leachate conveyance system. The location of this flow meter demarcates the landfill conveyance system from the GWA-owned and operated conveyance system. The flow meter has not been operational since the beginning of 2018.

Table 2.1 presents the GGH-reported leachate flows. A comparison of GWA-reported flows and Inarajan WWTP influent flow could not be made this quarter as the GWA-operated flow meter was out of service for the entire quarter.

Table 2.1. WWTP Influent and Leachate Flow Comparison (GGH)						
Month	Inarajan WWTP Influent Flow, gallons/day		Leachate Flow, gallons/day		Percent Leachate Flow to WWTP Influent Flow	
	Peak Day	Average Day	Peak Day	Average Day	Peak Day	Average Day
June	124,802	70,742	20,311	7,153	[1]	10.1
July	358,653	127,442	91,993	24,394	[1]	19.1
August	381,067	155,259	74,487	29,090	[1]	18.7

[1] See Attachment B.

The average peak day leachate flow percentages for the GGH-reported flows were calculated for each month of the quarter and are presented in Attachment B. On a monthly basis, the 30 percent average day trigger was not exceeded during the quarter.

The data in Attachment B show that the GGH-reported leachate flow exceeded the 30 percent peak day leachate flow trigger on four days during the quarter. The exceedances occurred on July 16, 2022, July 30, 2022, August 2, 2022, and August 27, 2022.

Rainfall data from the GGH's rain gauge (Attachment C) show that there were approximately 24.26 inches of rainfall between June 1, 2022 through August 31, 2022.

2.2. Leachate Quality Data

The leachate quality data consist of constituents that are related to potential oxygen demand on the Inarajan WWTP including biochemical oxygen demand (BOD), carbonaceous biochemical oxygen demand (cBOD), chemical oxygen demand (COD), and ammonia-N. The data also include other constituents that help characterize leachate quality. Leachate quality data were collected twice a month for the quarter. The leachate results are presented in Table 2.2.

Table 2.2. Layon Landfill Leachate Analytical Results						
Leachate (milligrams per liter, unless otherwise noted)	**2022 Sample Date**					
Constituents	**Jun 9**	**Jun 23**	**Jul 7**	**Jul 19**	**Aug 2**	**Aug 18**
Alkalinity	5,270	4,780	2,710	2,290	1,210	3,740
BOD	100	52	30	36	67	72
cBOD	112	34	26	28	53	68
COD	5,320	4,880	1,210	961	456	2,210
Ammonia as nitrogen	1,290	1,280	570	440	200	770
Total Kjeldahl nitrogen	2,050	1,940	836	888	284	879
pH (units)	7.70	6.68	7.53	7.66	6.02	7.11
Chloride	2,130	2,020	1,340	1,160	657	1,230
TSS	500	833	32.9	23.4	43.7	38.8
Temperature (°C)	29.08	26.19	29.71	28.04	29.59	28.01
Specific conductance (microSiemens per centimeter)	16,600	15,200	5,100	9,430	5,070	8,560

Figure 2.1 shows the leachate alkalinity, COD, ammonia, and total Kjeldahl nitrogen (TKN) trends from January 2018 through August 2022. The trends of alkalinity, COD, ammonia, and TKN are generally steady except in seasons of significant rainfall, such as August 2019, when over 17 inches of rainfall occurred and again in August 2022, when 9.8 inches of rainfall occurred. The constituent concentrations decreased significantly in August 2019 as well as August 2022, likely as a result of the dilution from the rainfall. Since that time, the trends of alkalinity, COD, ammonia, and TKN generally increased, track one another, and are approaching concentrations reported prior to the August 2019 rain event. Seasonal fluctuations are observed during the dry (generally January to May) and rainy (June through December) seasons.

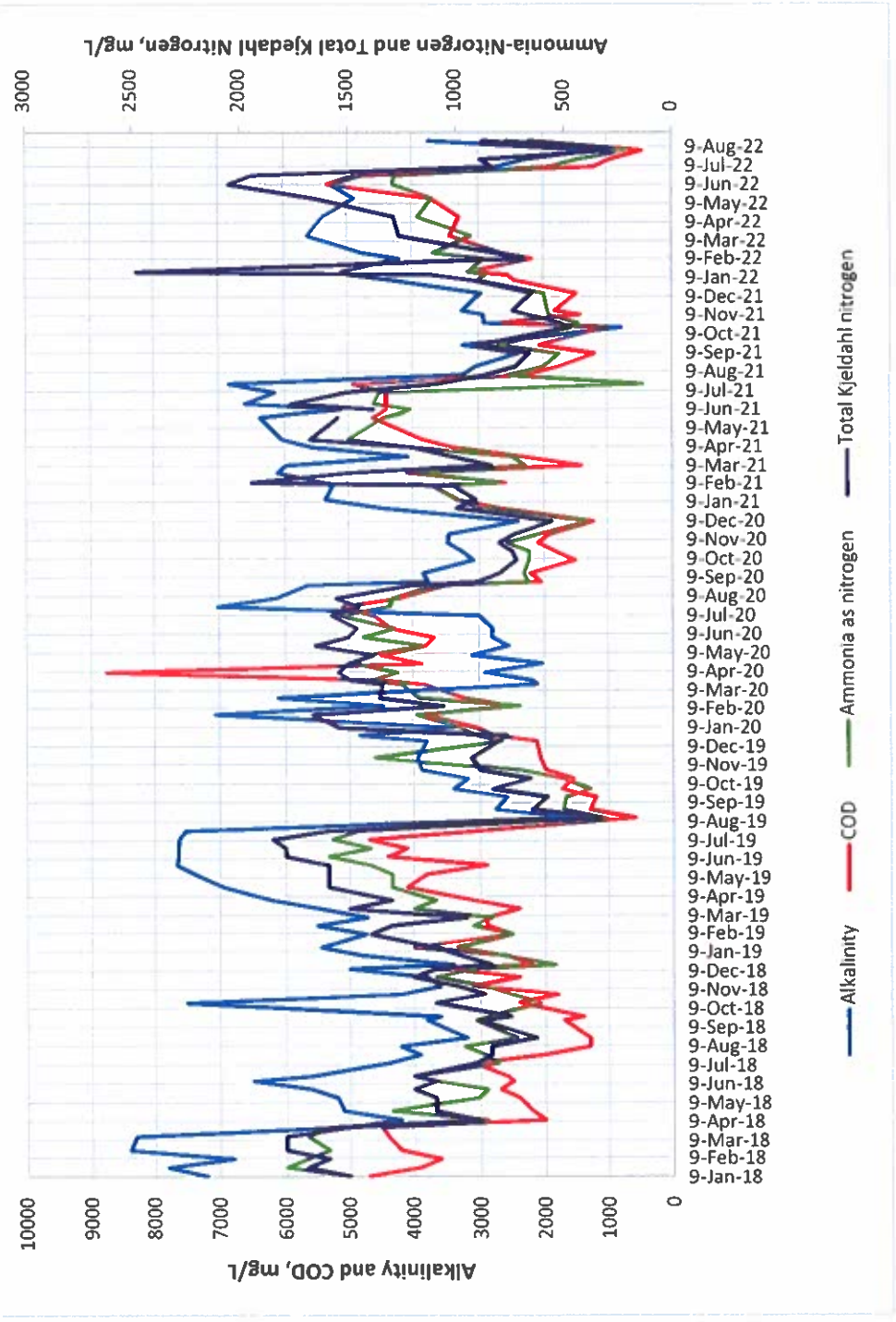

Figure 2.1. Leachate Trends for Alkalinity, COD, Ammonia-N, and TKN

Figure 2.2 shows the leachate BOD and cBOD trends from January 2018 through August 2022. The leachate BOD and cBOD concentrations had similar trends to the four parameters discussed above. A spike in BOD occurred in samples collected on July 8, 2020, August 26, 2020, and May 25, 2021, but the BOD and cBOD concentrations are still much lower than values that would normally be expected in leachate. Because the BOD and cBOD tests are biological in nature, it is possible that the increases in some leachate concentrations (particularly ammonia) may exert some toxic or inhibitory effects on the microorganisms in the BOD and cBOD test, thereby lowering the results. It is important to note that evidence of toxicity in the BOD and cBOD test does not indicate that toxicity is occurring in the WWTP. This issue has been discussed in previous technical memoranda (see Technical Memorandum 19).

The Inarajan WWTP's effluent pH is discussed in Section 1. The leachate pH (presented in Table 2.2) was below 6.8 for two days in this quarter. A decrease in leachate alkalinity may be a possible cause.

The general trend for the leachate quality constituents appears to be rainfall related. As the rainfall increases, the leachate is diluted, and the constituent concentrations decrease. As the rainfall decreases, the constituents in the leachate concentrate and the concentrations increase. Figure 2.3 shows the rainfall-parameter relationship with alkalinity and in general, an inverse relationship is seen between rainfall and alkalinity concentrations.

The leachate quality data for this quarter do not show evidence of abnormal variations or trends.

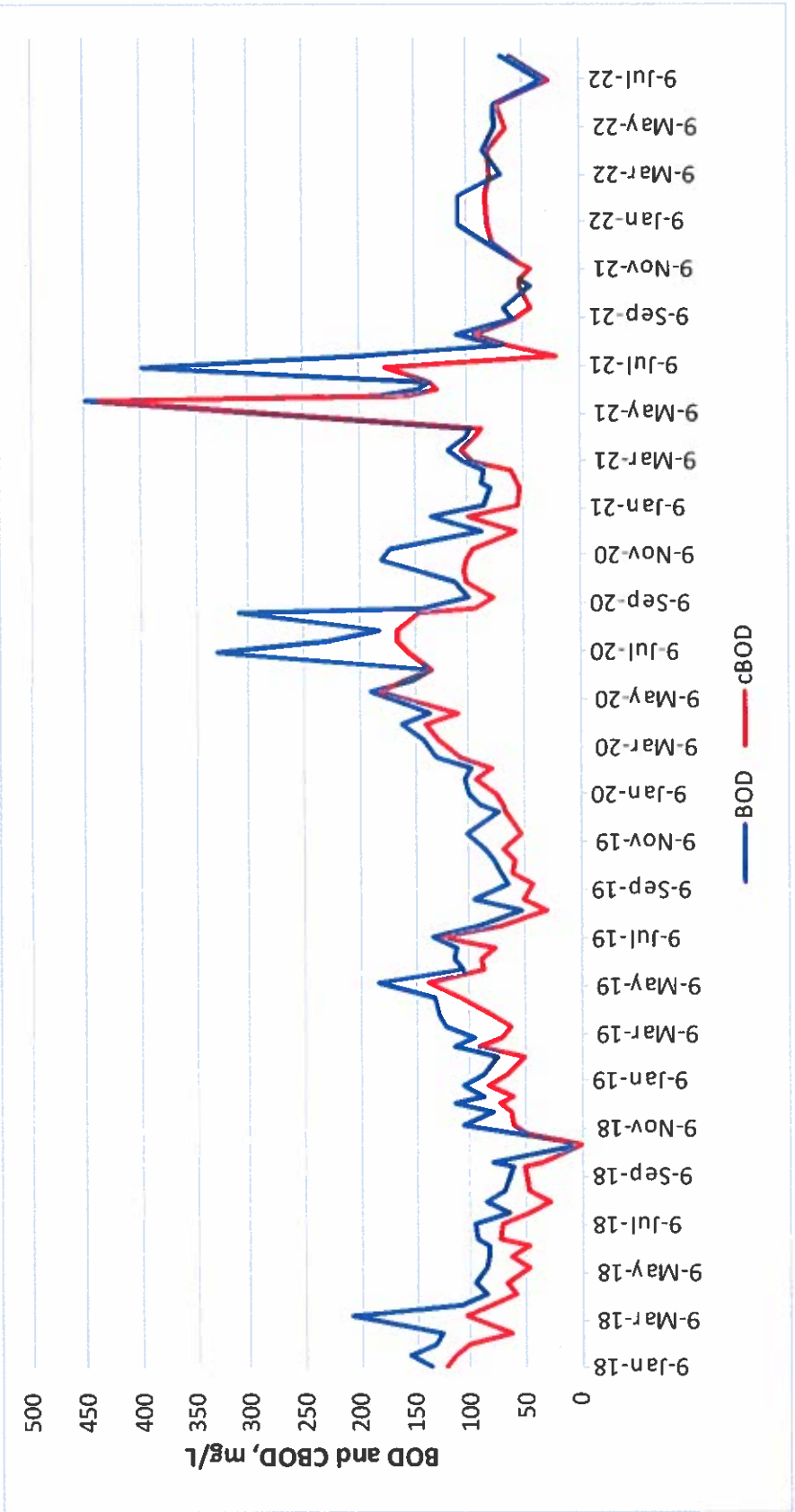

Figure 2.2. Leachate BOD and cBOD Trends

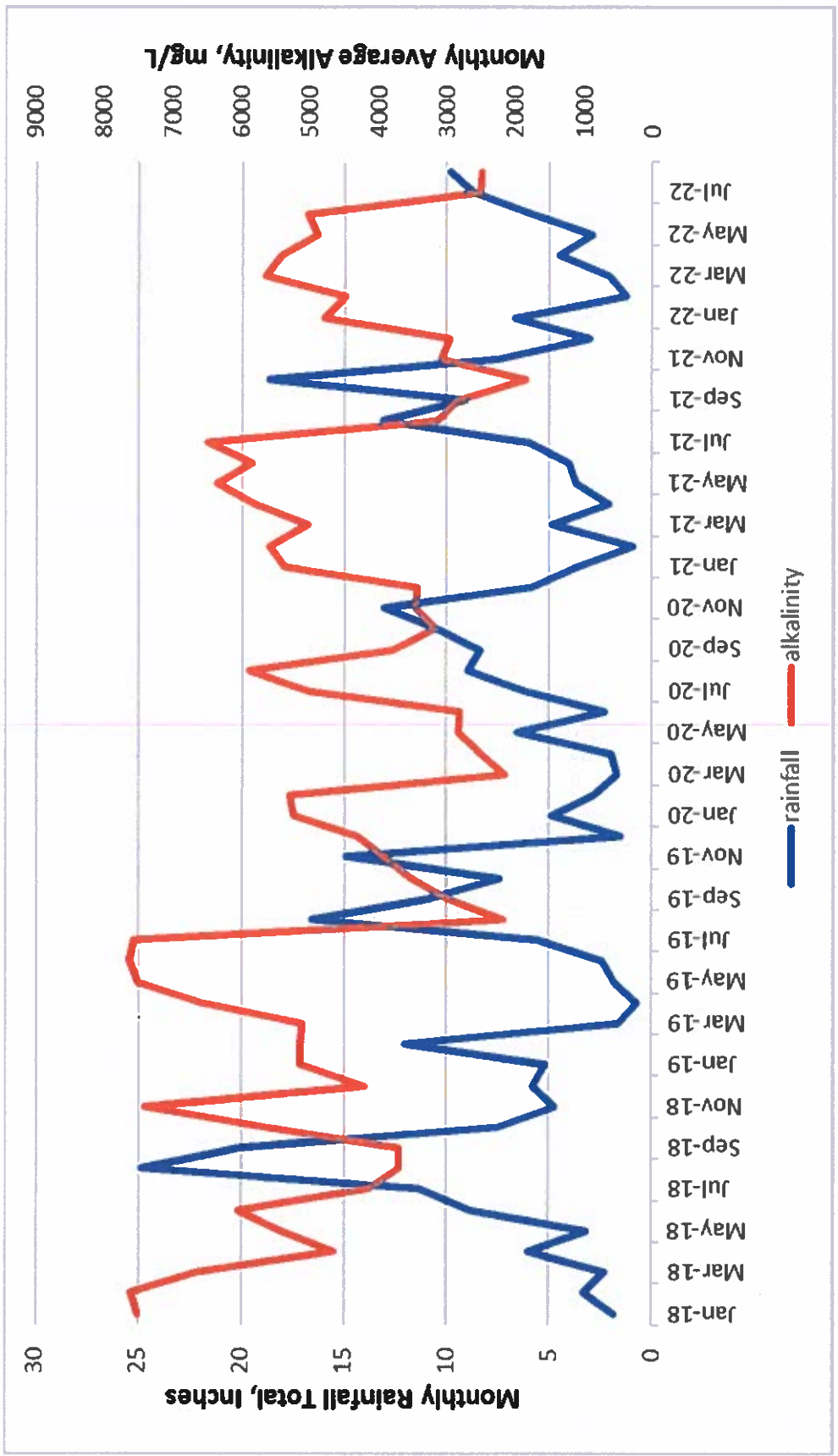

Figure 2.3. Rainfall-Alkalinity Relationship

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3. Assessment Summary

A summary of the key assessment issues discussed in the preceding sections is provided below:

- Monitoring reports prepared by GWA for the Inarajan WWTP reported effluent TSS for the three months of this quarter. There are insufficient data to assess the impact of leachate on the Inarajan WWTP. Leachate generally has low TSS concentrations, and the WWTP's effluent TSS could be influenced by conditions other than the leachate itself, including solids loss due to accumulated sludge in the treatment cells and algal growth in the supernatant of the cells.
- The GWA leachate flow meter was out of service for the entire quarter.
- Based on the GGH-reported leachate flows, the peak day leachate flow percentage was exceeded on four days during the quarter.
- The trends of alkalinity, COD, ammonia, and TKN generally increased during the quarter within the dry season and track with one another.
- The leachate BOD and cBOD concentrations followed the same trends as the constituents discussed in the previous bullet.
- The leachate quality data for this quarter do not show abnormal variations or trends.

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4. References

Brown and Caldwell, 2009, *Layon Landfill Leachate Treatment Feasibility Study*, September.

Brown and Caldwell, 2011, Inarajan Leachate Treatment Design and Consulting Services, Quality Assurance Project Plan, 15 February.

Brown and Caldwell, 2013. Technical Memorandum No. 11, *Water Quality Monitoring Report: March through May*, Inarajan Leachate Treatment Design and Consulting Services, 9 September 9.

Green Group Holdings, 2021. *Monthly Climatological Summary: March through May 2021.*

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Attachment A
Wastewater Treatment Plant and Leachate Flows – June 2022 through August 2022

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Attachment A

Inarajan Wastewater Treatment Plan Influent Flow Data

Date	Inarajan Wastewater Treatment Plan Influent Flow Data (gallons/day)		
	Jun-22	Jul-22	Aug-22
1	66,298	111,923	18,447
2	64,980	79,530	184,497
3	67,570	77,795	181,674
4	53,191	95,026	136,876
5	70,946	108,328	146,060
6	50,831	105,089	104,439
7	57,789	68,504	122,817
8	74,409	111,138	131,699
9	55,046	94,499	138,895
10	65,738	80,382	126,292
11	54,225	106,707	134,501
12	58,004	86,643	109,317
13	68,174	107,071	98,939
14	62,978	135,925	103,867
15	36,347	159,756	85,465
16	48,193	104,176	98,082
17	92,300	130,943	101,809
18	63,547	98,761	128,953
19	62,486	101,192	110,186
20	83,041	97,815	111,865
21	97,214	80,917	160,759
22	64,476	96,190	381,067
23	102,074	78,964	278,752
24	84,549	91,785	260,590
25	80,821	135,997	210,688
26	68,154	267,475	194,619
27	124,802	358,653	156,751
28	78,068	251,335	161,784
29	87,572	227,393	146,179
30	78,449	140,196	174,551
31	-	160,606	312,600
Maximum	124,802	358,653	381,067
Minimum	36,347	68,504	18,447
Average	70,742	127,442	155,259

Attachment A

Leachate Flow Data (gallons/day)

Date	Month					
	Jun-22		Jul-22		Aug-22	
	GGH	GWA	GGH	GWA	GGH	GWA
1	7,200	a	7,200	a	39,159	a
2	2,624	a	21,843	a	62,489	a
3	11,919	a	NR	a	54,503	a
4	7,100	a	6,200	a	27,087	a
5	NR	a	23,048	a	29,800	a
6	0	a	15,800	a	10,576	a
7	0	a	7,400	a	NR	a
8	17,577	a	16,332	a	34,463	a
9	3,000	a	21,610	a	21,003	a
10	6,900	a	NR	a	12,348	a
11	0	a	16,872	a	18,451	a
12	NR	a	13,500	a	13,179	a
13	14,191	a	22,857	a	26,042	a
14	0	a	4,000	a	NR	a
15	6,800	a	24,835	a	5,700	a
16	0	a	37,888	a	17,447	a
17	14,040	a	NR	a	9,617	a
18	0	a	3,900	a	15,729	a
19	NR	a	9,900	a	10,600	a
20	6,900	a	14,676	a	28,491	a
21	7,554	a	0	a	NR	a
22	7,000	a	14,484	a	38,684	a
23	7,000	a	21,600	a	43,639	a
24	6,924	a	NR	a	33,688	a
25	6,900	a	17,670	a	33,706	a
26	NR	a	53,226	a	33,006	a
27	20,311	a	91,993	a	55,073	a
28	9,700	a	59,888	a	NR	a
29	15,045	a	50,189	a	3,767	a
30	7,300	a	57,321	a	32,707	a
31	-	a	NR	a	74,487	a
Total	185,985	a	634,232	a	785,441	a
Maximum	20,311	a	91,993	a	74,487	a
Minimum	0	a	0	a	0	a
Average	7,153	a	24,394	a	29,090	a

Notes

NR - Not reported

a - Leachate flow meter operated and maintained by GWA was out of service.

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Attachment B

Daily Leachate Flow Percentages – June 2022 through August 2022

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Attachment B

Leachate Percentage of Plant Flow - Peak Day

Date	Jun-22					Jul-22					Aug-22				
	Influent Quantity (gallons/day)	GGH Leachate (gallons/day)	GGH Peak Day %	GWA Leachate (gallons/day)	GWA Peak Day %	Influent Quantity (gallons/day)	GGH Leachate (gallons/day)	GGH Peak Day %	GWA Leachate (gallons/day)	GWA Peak Day %	Influent Quantity (gallons/day)	GGH Leachate (gallons/day)	GGH Peak Day %	GWA Leachate (gallons/day)	GWA Peak Day %
1	66,298	7,200	11	b	b	111,923	7,200	6	b	b	18,447	39,159	212	b	b
2	64,980	2,624	4	b	b	79,530	21,843	27	b	b	184,497	62,489	34	b	b
3	67,570	11,919	18	b	b	77,795	NR	a	b	b	181,674	54,503	30	b	b
4	53,191	7,100	13	b	b	95,026	6,200	7	b	b	136,876	27,087	20	b	b
5	70,946	NR	a	b	b	108,328	23,048	21	b	b	146,060	29,800	20	b	b
6	50,831	0	0	b	b	105,089	15,800	15	b	b	104,439	10,576	10	b	b
7	57,789	0	0	b	b	68,504	7,400	11	b	b	122,817	NR	a	b	b
8	74,409	17,577	24	b	b	111,138	16,332	15	b	b	131,699	34,463	26	b	b
9	55,046	3,000	5	b	b	94,499	21,610	23	b	b	138,895	21,003	15	b	b
10	65,738	6,900	10	b	b	80,382	NR	a	b	b	126,292	12,348	10	b	b
11	54,225	0	0	b	b	106,707	16,872	16	b	b	134,501	18,451	14	b	b
12	58,004	NR	a	b	b	86,643	13,500	16	b	b	109,317	13,179	12	b	b
13	68,174	14,191	21	b	b	107,071	22,857	21	b	b	98,939	26,042	26	b	b
14	62,978	0	0	b	b	135,925	4,000	3	b	b	103,867	NR	a	b	b
15	36,347	6,800	19	b	b	159,756	24,835	16	b	b	85,465	5,700	7	b	b
16	48,193	0	0	b	b	104,176	37,888	36	b	b	98,082	17,447	18	b	b
17	92,300	14,040	15	b	b	130,943	NR	a	b	b	101,809	9,617	9	b	b
18	63,547	0	0	b	b	98,761	3,900	4	b	b	128,953	15,729	12	b	b
19	62,486	NR	a	b	b	101,192	9,900	10	b	b	110,186	10,600	10	b	b
20	83,041	6,900	8	b	b	97,815	14,676	15	b	b	111,865	28,491	25	b	b
21	97,214	7,554	8	b	b	80,917	0	0	b	b	160,759	NR	a	b	b
22	64,476	7,000	11	b	b	96,190	14,484	15	b	b	381,067	38,684	10	b	b
23	102,074	7,000	7	b	b	78,964	21,600	27	b	b	278,752	43,639	16	b	b
24	84,549	6,924	8	b	b	91,785	NR	a	b	b	260,590	33,688	13	b	b
25	80,821	6,900	9	b	b	135,997	17,670	13	b	b	210,688	33,706	16	b	b
26	68,154	NR	a	b	b	267,475	53,726	20	b	b	194,619	33,006	17	b	b
27	124,802	20,311	16	b	b	358,653	91,993	26	b	b	156,751	55,073	35	b	b
28	78,068	9,700	12	b	b	251,335	59,888	24	b	b	161,784	NR	a	b	b
29	87,572	15,045	17	b	b	227,393	50,189	22	b	b	146,179	3,767	3	b	b
30	78,449	7,300	9	b	b	140,196	57,523	41	b	b	174,551	32,707	19	b	b
31						160,606	NR				312,600	74,487	24	b	b
Total	2,122,277	185,985		b		3,950,714	634,732		b		4,813,020	785,441		b	
Maximum	124,802	20,311		b		358,653	91,993		b		381,067	74,487		b	
Minimum	36,347	0		b		68,504	0		b		18,447	0		b	
Average (gallons/day)	70,742	7,153		b		127,442	24,394		b		155,259	29,090		b	

Note:

Cells highlighted in yellow/bold show days when the 30% peak day trigger exceeded.

NR - GGH daily leachate flows were not reported.

a - cannot calculate because daily leachate flows were not reported.

b - Leachate flow meter operated and maintained by GWA was out of service.

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Attachment C

Green Group Holdings Rainfall Data

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MONTHLY CLIMATOLOGICAL SUMMARY for JUN. 2022

NAME: GGH Guam CITY: Inarajan STATE: Guam
ELEV: 359 ft LAT: 13° 18' 00" N LONG: 144° 48' 00" E

TEMPERATURE (°F), RAIN (in), WIND SPEED (mph)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	80.7	87.4	2:30p	75.8	3:00a	0.0	15.7	0.03	2.4	15.0	10:30a	ESE
2	81.0	88.2	1:00p	76.0	5:30a	0.0	16.0	0.01	3.5	16.0	4:00p	NE
3	80.9	87.0	2:00p	76.4	8:30a	0.0	15.9	0.18	4.2	20.0	8:00a	ESE
4	80.9	88.2	2:30p	75.3	5:00a	0.0	15.9	0.01	3.2	19.0	2:30p	ESE
5	82.0	87.9	12:30p	77.6	9:00p	0.0	17.0	0.00	4.6	19.0	2:30p	E
6	82.0	88.1	11:30a	76.8	12:00m	0.0	17.0	0.00	6.3	20.0	4:00p	ENE
7	81.5	89.0	2:00p	75.2	3:30a	0.0	16.5	0.00	4.9	19.0	10:00a	E
8	82.3	89.1	1:00p	75.9	3:30a	0.0	17.3	0.17	8.6	23.0	1:30p	ENE
9	82.5	88.3	12:00p	78.4	4:30a	0.0	17.5	0.02	8.5	24.0	11:30a	E
10	82.7	88.6	1:30p	76.0	4:30a	0.0	17.7	0.17	10.2	37.0	4:00a	ENE
11	81.2	86.6	11:30a	75.9	5:00p	0.0	16.2	0.28	8.3	28.0	11:30a	ENE
12	81.9	86.8	10:00a	77.1	10:30a	0.0	16.9	0.36	4.9	18.0	10:30a	ESE
13	82.7	88.2	1:30p	78.2	3:00a	0.0	17.7	0.00	7.6	23.0	1:00p	E
14	81.9	87.8	2:00p	77.4	4:30a	0.0	16.9	0.12	6.3	19.0	2:00p	ENE
15	82.9	88.4	1:00p	78.4	4:30a	0.0	17.9	0.00	9.4	21.0	11:00a	ENE
16	81.3	87.2	3:00p	76.6	5:30p	0.0	16.3	0.39	8.2	25.0	11:30a	ENE
17	80.5	88.3	1:30p	73.2	8:30p	0.0	15.5	0.52	6.5	29.0	6:00p	ENE
18	80.9	87.5	12:30p	73.7	1:00a	0.0	15.9	0.00	4.6	17.0	1:00p	ENE
19	82.5	89.4	1:30p	77.0	12:00m	0.0	17.5	0.22	4.0	16.0	11:30a	E
20	78.5	84.2	11:30a	73.0	5:30a	0.0	13.5	0.53	3.7	15.0	4:30a	ESE
21	79.0	86.3	11:30a	75.2	5:30p	0.0	14.0	0.61	2.8	23.0	3:00p	ESE
22	80.8	86.9	11:30a	74.5	5:30a	0.0	15.8	0.07	3.8	17.0	1:00p	ESE
23	80.6	87.9	1:00p	74.4	6:30a	0.0	15.6	0.06	7.1	25.0	4:30p	ENE
24	80.4	86.3	1:30p	75.3	10:00a	0.0	15.4	0.89	7.5	27.0	9:30a	E
25	81.8	87.0	11:30a	77.2	5:30a	0.0	16.8	0.20	8.3	28.0	4:30p	ENE
26	81.9	87.6	1:30p	75.9	7:30a	0.0	16.9	0.23	10.3	31.0	9:30a	ENE
27	78.7	85.3	2:00p	73.6	9:00a	0.0	13.7	0.68	2.0	22.0	9:00a	E
28	79.4	85.7	1:30p	74.1	1:00a	0.0	14.4	0.01	2.2	14.0	11:00a	ESE
29	81.0	87.9	2:00p	75.9	6:00a	0.0	16.0	0.00	2.1	13.0	10:00a	E
30	82.2	88.1	12:00p	76.8	9:00p	0.0	17.2	0.01	6.0	30.0	8:30p	E
	81.2	89.4	19	73.0	20	0.0	486.6	5.77	5.7	37.0	10	ENE

Max >= 90.0: 0
Max <= 32.0: 0
Min <= 32.0: 0
Min <= 0.0: 0
Max Rain: 0.89 ON 06/24/22
Days of Rain: 19 (>.01 in) 15 (>.1 in) 0 (>1 in)
Heat Base: 65.0 Cool Base: 65.0 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for JUL. 2022

NAME: GGH Guam CITY: Inarajan STATE: Guam
ELEV: 359 ft LAT: 13° 18' 00" N LONG: 144° 48' 00" E

TEMPERATURE (°F), RAIN (in), WIND SPEED (mph)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	81.4	87.3	3:00p	76.0	1:00a	0.0	16.4	0.57	7.2	21.0	1:30p	E
2	81.7	87.3	12:00p	78.0	3:30a	0.0	16.7	0.18	8.4	25.0	12:30p	E
3	79.7	83.5	4:00p	74.6	6:30a	0.0	14.7	0.36	4.8	25.0	6:00a	ENE
4	79.2	85.4	9:00a	75.6	4:00p	0.0	14.2	0.27	3.3	21.0	9:30a	E
5	80.3	86.7	2:00p	74.9	6:00a	0.0	15.3	0.11	5.1	23.0	11:30a	NE
6	80.9	86.5	10:30a	77.5	6:30a	0.0	15.9	0.06	5.1	23.0	1:30p	ESE
7	80.9	85.9	12:00p	74.6	10:30p	0.0	15.9	0.26	5.0	23.0	12:30p	ESE
8	78.4	82.1	12:30p	76.1	12:30a	0.0	13.4	0.17	2.8	18.0	4:00p	SSE
9	77.8	83.1	10:00a	75.9	11:00a	0.0	12.8	0.34	2.4	19.0	10:30a	S
10	80.4	86.4	2:30p	75.4	3:00a	0.0	15.4	0.01	3.7	15.0	10:30a	ENE
11	81.7	86.7	1:30p	77.6	6:30a	0.0	16.7	0.06	6.8	23.0	11:00a	ESE
12	82.0	88.5	1:30p	76.9	8:30p	0.0	17.0	0.06	6.7	22.0	11:00a	ENE
13	81.8	88.2	12:30p	76.5	11:00p	0.0	16.8	0.17	6.3	19.0	9:00a	ENE
14	78.6	84.9	12:30p	75.1	1:30a	0.0	13.6	0.42	3.4	21.0	6:30a	ESE
15	81.3	86.7	2:00p	77.1	6:30a	0.0	16.3	0.07	3.8	17.0	12:00p	ESE
16	82.5	87.9	2:00p	77.4	3:00a	0.0	17.5	0.01	7.8	23.0	2:00p	E
17	80.6	86.8	2:00p	76.9	12:00m	0.0	15.6	0.26	4.0	18.0	3:00a	E
18	81.4	87.2	3:30p	76.3	4:00a	0.0	16.4	0.21	5.5	18.0	9:30a	ENE
19	82.2	88.2	12:30p	77.2	4:30a	0.0	17.2	0.04	5.8	19.0	3:30p	ENE
20	81.5	87.2	11:00a	77.7	1:30a	0.0	16.5	0.04	4.4	17.0	1:00a	E
21	78.9	83.9	10:30a	76.1	5:00a	0.0	13.9	0.01	2.7	19.0	11:30a	SSE
22	80.5	85.7	12:30p	74.5	6:00a	0.0	15.5	0.62	5.1	26.0	3:30a	SSE
23	81.4	86.3	2:30p	76.3	1:30a	0.0	16.4	0.55	3.6	19.0	12:30a	SSE
24	80.6	87.7	1:00p	76.5	2:00a	0.0	15.6	0.14	3.5	15.0	12:30p	E
25	78.0	86.4	11:00a	75.5	11:30p	0.0	13.0	0.85	1.5	14.0	1:00p	S
26	78.4	83.1	1:30p	75.2	12:00m	0.0	13.4	1.29	6.0	24.0	12:00m	SSW
27	78.1	82.8	3:00p	72.8	7:30a	0.0	13.1	1.23	4.7	26.0	2:00a	S
28	81.4	86.6	3:30p	77.3	4:30a	0.0	16.4	0.03	3.6	16.0	1:00p	ESE
29	78.5	83.4	10:30a	75.6	9:30p	0.0	13.5	0.19	2.3	22.0	4:00a	SSW
30	79.7	86.7	1:30p	76.1	6:30a	0.0	14.7	0.00	2.8	17.0	1:00p	ENE
31	80.2	88.2	1:00p	75.7	7:00p	0.0	15.2	0.08	4.3	25.0	3:30p	E
	80.3	88.5	12	72.8	27	0.0	475.0	8.66	4.6	26.0	22	ENE

Max >= 90.0: 0
Max <= 32.0: 0
Min <= 32.0: 0
Min <= 0.0: 0
Max Rain: 1.29 ON 07/26/22
Days of Rain: 27 (>.01 in) 19 (>.1 in) 2 (>1 in)
Heat Base: 65.0 Cool Base: 65.0 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for AUG. 2022

NAME: GGH Guam CITY: Inarajan STATE: Guam
ELEV: 359 ft LAT: 13° 18' 00" N LONG: 144° 48' 00" E

TEMPERATURE (°F), RAIN (in), WIND SPEED (mph)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	81.7	87.1	3:00p	76.2	12:30a	0.0	16.7	0.54	7.8	23.0	9:30p	ENE
2	80.3	84.7	2:00p	75.8	1:30a	0.0	15.3	0.19	4.4	24.0	1:00a	NNE
3	81.4	87.5	1:00p	76.9	11:30p	0.0	16.4	0.15	4.0	16.0	9:30a	E
4	81.4	87.7	1:00p	77.0	12:00m	0.0	16.4	0.01	1.9	14.0	12:30p	SSE
5	81.3	87.5	12:00p	76.0	5:00a	0.0	16.3	0.07	3.5	19.0	12:00p	E
6	80.3	87.4	11:00a	76.1	5:00a	0.0	15.3	0.43	3.6	19.0	2:00p	ENE
7	80.9	87.7	1:30p	76.2	5:30a	0.0	15.9	0.12	2.9	19.0	8:30a	E
8	80.3	87.7	2:00p	73.4	5:00a	0.0	15.3	0.85	2.7	15.0	12:00p	ENE
9	80.9	87.5	12:00p	75.7	1:30a	0.0	15.9	0.00	3.1	14.0	11:30a	ENE
10	79.7	86.2	2:30p	75.3	4:30a	0.0	14.7	0.27	5.3	22.0	4:00a	ENE
11	81.3	87.8	11:30a	77.5	12:30a	0.0	16.3	0.04	3.2	15.0	1:30p	ESE
12	79.7	86.1	12:00p	76.1	5:00a	0.0	14.7	0.14	2.3	20.0	12:00p	ESE
13	80.4	85.9	12:30p	76.6	6:30a	0.0	15.4	0.02	2.8	16.0	1:30p	E
14	80.4	85.6	12:00p	74.8	3:30a	0.0	15.4	0.07	6.2	20.0	2:00p	ESE
15	81.9	87.2	12:00p	77.4	6:30a	0.0	16.9	0.00	4.8	17.0	11:30a	ENE
16	81.9	88.6	12:30p	77.1	5:00p	0.0	16.9	0.08	8.3	24.0	1:30p	ENE
17	77.3	82.1	4:00p	73.5	8:30a	0.0	12.3	1.04	5.3	26.0	6:30a	S
18	81.0	87.9	1:30p	75.9	6:30a	0.0	16.0	0.02	3.5	17.0	10:00a	ENE
19	79.0	83.8	3:30p	75.5	6:00a	0.0	14.0	0.07	3.8	14.0	8:30a	NE
20	78.6	84.0	4:00p	72.4	4:00a	0.0	13.6	0.28	3.1	19.0	3:30a	NNE
21	78.7	83.3	4:00p	74.5	9:00a	0.0	13.7	0.33	2.6	20.0	9:00a	ESE
22	77.5	85.2	10:30a	73.8	1:30p	0.0	12.5	1.10	3.8	20.0	1:00p	SSW
23	79.6	86.0	2:00p	73.8	12:00m	0.0	14.6	0.33	4.5	20.0	7:00a	WSW
24	79.1	85.8	11:30a	72.8	1:00a	0.0	14.1	0.24	2.3	17.0	10:30a	S
25	80.7	87.6	2:00p	75.7	2:00a	0.0	15.7	0.01	1.8	12.0	11:00a	E
26	77.2	80.2	2:00p	74.8	11:30a	0.0	12.2	0.17	1.3	14.0	11:00a	NNE
27	79.9	86.3	1:30p	75.7	5:00a	0.0	14.9	0.00	1.7	14.0	12:30p	SSE
28	79.9	87.6	1:30p	76.2	11:30p	0.0	14.9	0.03	1.8	15.0	12:00p	E
29	80.4	87.8	2:00p	75.7	6:00a	0.0	15.4	0.01	2.8	15.0	1:30p	NE
30	79.9	85.7	1:00p	74.3	7:30a	0.0	14.9	0.33	2.4	19.0	6:30a	SE
31	76.7	79.9	6:00p	72.5	8:00a	0.0	11.7	2.89	2.4	14.0	6:30a	SSE
	80.0	88.6	16	72.4	20	0.0	464.3	9.83	3.5	26.0	17	ENE

Max >= 90.0: 0
Max <= 32.0: 0
Min <= 32.0: 0
Min <= 0.0: 0
Max Rain: 2.89 ON 08/31/22
Days of Rain: 25 (>.01 in) 17 (>.1 in) 3 (>1 in)
Heat Base: 65.0 Cool Base: 65.0 Method: Integration