RESPONSES TO COMMENTS

UNITED STATES NUCLEAR REGULATORY COMMISSION COMMENTS REGARDING THE DRAFT FINAL SAMPLING AND ANALYSIS PLANS FOR THE REMEDIAL INVESTIGATIONS AT SPRING CREEK PARK AND DEAD HORSE BAY SITES GATEWAY NATIONAL RECREATION AREA, NEW YORK

Final **December 4, 2024**

Comment 1: Limited Gamma Walkover Survey Coverage: The NRC staff recommends that the NPS provide a discussion of decision-making procedures for determining gamma walkover survey (GWS) coverage and estimating the potential distribution of radiological contamination at the site.

Description: In Section 2.2 of both the SCP and DHB SAPs, NPS details previous GWSs with limited coverage of each site. For example, the SCP SAP (page 34) describes surveys along fire roads plus a 10-foot buffer on each side of the road—Figure 2-12 presents the results. It is noted that some areas received additional coverage, specifically the southeastern sector, though most of the property remains unscanned. Overall, based on visual inspection by NRC's contractor, survey results appear to represent 5- to 10-percent coverage. Figure 2-12 of the SCP SAP also illustrates locations where discreet sources of radium were identified, including three deck markers and one radium clip.

Similarly, in the DHB SAP, the NPS describes a GWS for various areas including trails and beaches initially, then alternating 1-acre grids in the southern portion of the site, and additional coverage in the vicinity of the marina (see Figure 2-11). Based on visual inspection by NRC's contractor, survey results appear to represent approximately 30- to 40-percent coverage on the southern portion and 5- to 10-percent in the northern portion. Section 2.2.2 of the DHB SAP details the identification of two radium deck markers in the initial GWS of trails and beaches in the southern portion of the site. Section 2.2.4 of the DHB SAP indicates that several elevated anomalies were identified but not investigated further, and further radiological investigations will be performed as part of the current phase of the remedial investigation to better characterize radiological sources and the nature and extent of radiological contamination at the site.

It is not known if the distributions of identified radiological artifacts is representative of the site as a whole or if larger concentrations of sources are in areas of both sites that were not scanned.

Assuming 10-percent coverage was achieved at SCP, one can conclude, based on pure randomness, that a total of 40 discrete sources could be distributed across the property. In Section 5.5 of the SCP SAP, NPS describes GWSs with limited coverage goals that essentially rescan previous areas to address data quality issues identified in Section 2.2.7 of the SCP SAP. While NPS does not propose GWS for this phase of the remedial investigation at DHB, similar uncertainty exists given the currently available data from previous investigations.

According to one reference (Oak Ridge Associated Universities Museum of Radiation and Radioactivity1), total Ra-226 activity in deck markers can range from 5 to 15 microcuries. Activity in a radium clip is expected to be on the same order of magnitude. The markers, clips, etc., are relatively small, and the probability of being sampled via random or systematic sampling is remote at best. The best method for identifying those sources with the most confidence is, therefore, via a high-density GWS. Given any one discreet source could have microcurie-level contamination and given the broad and seeming random distribution of sources identified at these NPS sites, 100% coverage seems prudent, and would be consistent with guidance in NUREG-1757, Volume 2, Appendix A for scanning coverage of Class 1 impacted areas. The NPS should provide additional justification for limiting GWS coverage at each of the sites to support proper classification of the sites and plan remedial efforts to ensure NRC's applicable dose criterion will be met by NPS's eventual remedy.

Basis: Section 4.2 of Revision 2 of NUREG-1757, Volume 2, "Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria" (ADAMS Accession No. ML22194A859), provides guidance for conducting adequate scoping and characterization surveys for the purposes of supporting a demonstration that dose criterion specified in either 10 CFR 20.1402 or 20.4103(b) are met after remediation. Characterization surveys should be sufficiently comprehensive to provide data for properly classifying areas as impacted or non-impacted and subsequent planning of the remedial action. Adequate site characterization is needed to

understand the spatial extent of radiological contamination and justify the eventual remedy selected to provide reasonable assurance that NPS's remedy meets the applicable dose criterion in either 10 CFR 20.1402, for unrestricted use, or the requirements in 10 CFR 20.1403(b), for restricted use.

NPS Response: The approach to radiological investigations for Spring Creek Park (SCP) and Dead Horse Bay (DHB) is to confirm that the conceptual site model (CSM) that was established at Great Kills Park (GKP) is the same at these two sites. GKP was the first of the three Gateway Sites to be investigated for radiological contamination (i.e., in addition to a broad list of chemical contaminants). The radiological investigation at GKP involved completing gamma surveys over 100% of the waste filled area. The investigation confirmed that discrete artifacts and distributed radiological contamination, primarily radium-226 and to a lesser extent thorium-232 and uranium-238, is associated with waste fill. The radiological investigations for SCP and DHB were initiated due to their similar history (i.e., both created through historical landfilling operations performed by New York City). The reduced GWS coverage is appropriate for SCP and DHB because radiological contamination has already been discovered in waste filled areas at both sites, both sites have the same operational history as GKP, and 50% GWS coverage combined with our focused radiological investigation approach will generate sufficient site data to confirm that the CSMs at both sites are the same as GKP (i.e., radiological contamination is associated with waste fill, and wherever waste fill is present, there is a likelihood of encountering radiological contamination). NPS's current plan is to determine the waste fill extents and complete gamma surveys over roughly 50% of SCP and DHB so that there are sufficient radiological anomalies within the surveyed area to support focused radiological investigations to characterize the nature of radiological contamination (including radiological sources in waste fill) and to inform the human health risk assessment and radiological dose assessment.

The gamma surveys are being conducted to support worker health and safety and site management decisions and, as a result, these tasks were not specifically included in the fieldwork specified in the RI SAPs. However, the gamma surveys are considered usable for characterizing radiological contamination that can be detected at the ground surface and will be used in the RI to support the selection of areas for focused radiological investigations at both sites. The maps presented in **Attachment 1** provide a summary of the gamma surveys that have been conducted and/or are planned at DHB and SCP. In addition to the gamma surveys shown in **Attachment 1**, gamma surveys will also be performed in the northern portion of DHB (i.e., targeting approximately 50% coverage) once the extent of waste fill is defined through the activities described in the Phase 1 RI SAP for DHB.

Both SCP and DHB were created through historical landfilling operations conducted by New York City and radiological contamination has already been discovered at both sites during limited investigations around paths and accessible areas. NPS is confident that 50% GWS survey coverage along with waste fill delineations will provide sufficient radiological anomalies to further characterize the radiological impacts associated with waste fill at both sites. Also, NPS anticipates that CERCLA response actions will be required to protect human health, achieve federal and state dose limits, and protect the environment prior to reopening any of these sites to the public (i.e., these sites are not being considered for unrestricted release in their current condition). Impacted areas of GKP, SCP, and DHB will remain closed while NPS sequences through the CERCLA process.

Comment 2: Investigation Level Statistics: The NRC staff recommends that the NPS describe the process for managing data to ensure the calculated z-score value will target the appropriate medium-specific response.

Description: In Section 5.5 of the SCP SAP, NPS states that a z-score greater than three will be considered indicative of contamination. Radiation survey planners often provide an investigation level that, when encountered, will prompt more detailed surveys and/or sampling. The goal is to limit false negative decisions (i.e., to limit the possibility of concluding that a medium is uncontaminated when, in fact, the medium is contaminated). Investigation levels have sometimes been established using historical precedence (i.e., NRC Regulatory Guide 1.86), industry guidance (e.g., per NUREG-1507), somewhat arbitrary guidelines (e.g., twice background), or other methods. The z-score approach is used at some sites, where a z-score is selected to represent a value sufficiently above the mean of the population to warrant additional consideration. For example, for a dataset with a normal distribution, over 99 percent of the results will fall below a measurement corresponding to a z-score = 3. An investigation level corresponding to z-score = 3

seems, therefore, to be a reasonable, non-arbitrary, and site- specific approach for the remedial investigation. However, the basis for the z-score selection must be understood and correctly managed to achieve the intended goal.

The NPS' site descriptions in Section 2.1.4 of the SCP and DHB SAPs notes that sewage amended soils mixed with clay, artificial fills, including hydraulic fills (i.e., sands) and waste fills, and discrete areas of construction and demolition debris, among other media that may be subject to radiological surveys. Further, the DHB SAP in Section 2.2.2 indicates monazite samples (elevated in thorium and other naturally radioactive constituents) were identified in previous investigations,

The presumption that contaminated environmental media can be surveyed and a distinct "background" detector response sample population obtained may be reasonable if the media is impacted, as purported by NPS, by discrete, or localized, contaminants such as man-made radiological articles. Further, assuming that each background response sample population is normally distributed, it is likely that the various environmental media will exhibit varying responses (e.g., the background response for monazite sands are likely to be significantly higher than fill material, clay, or other soil-like media). It is unclear to NRC staff whether the NPS plans to establish investigation levels for each media or from a site-wide population across all media.

NUREG-1507 describes how survey planners could erroneously group all survey data across different media or media with statistically different response distributions into a single population. As described in NUREG-1507, such errors can grossly overestimate the z-score value, thus increasing the potential for false negative decision errors. NPS should ensure that, if z-scores are used as investigation levels, the z-score value or values are based on medium- specific responses to avoid undermining the basis for the statistic and increasing the probability of false negative decision errors.

Basis: Adequate site characterization is needed to identify and delineate the spatial extent of contamination and to justify the eventual remedy selected to provide reasonable assurance that NPS's remedy meets the NRC's dose criterion in either 10 CFR 20.1402, for unrestricted use, or the requirements in 10 CFR 20.1403(b), for restricted use.

> **NPS Response:** NPS understands and agrees with NRC's concerns regarding the Z-score approach described for evaluating gamma survey results and identifying radiological anomalies indicative of potential contamination. The SAPs present the simplest form of the Z-score evaluation in order to convey the general framework that will be used to evaluate the gamma survey data. In practice, NPS implements a more refined and rigorous data processing approach that involves: (1) evaluating gamma survey results in population subsets that are generally one acre in size or less to address the potential for variability in site media, (2) conducting statistical evaluations of each data subset using USEPA's ProUCL software (i.e., descriptive statistics to include evaluations of the kurtosis and skewness of the data subset, time-series data plots, quantile-quantile plots, and histograms) to ensure the subset population is appropriate for identifying contamination using a Z-score evaluation, (3) performing an iterative or modified Z-score approach to address high outliers (if necessary) that may bias the Z-score evaluation in a manner that could result in false negatives, and (4) mapping the resulting gamma survey data based on class-posted count rates, class-posted Z-scores, and contoured Z-scores to clearly map radiological anomalies using multiple approaches to ensure hotspots are not missed. **Attachment 2** presents figures of example data subsets from DHB to demonstrate how the gamma survey data were evaluated. NPS prefers to maintain the SAP in its current form in order to provide an appropriate amount of flexibility for evaluating the gamma survey results.

Comment 3: Conceptual Model for Radionuclides of Potential Concern: The NPS should 1) describe why discrete sources of radium are not like other (environmental) contaminants, 2) discuss methods to address these discrete Ra-226-bearing artifacts, and 3) clearly describe how presence/absence decisions are made.

Description: Section 2.4 of both the SCP and DHB SAPs describes the NPS' conceptual model that is based on its current understanding of the site characteristics and contamination. In its description of the conceptual models, the NPS presents the likely source of contamination from waste fill containing incidental radiological artifacts/contamination (see Figures 2-15 and 2-14 of the SCP and DHB SAPs, respectively).

Further, in Section 4.2.1 of both the SCP and DHB SAPs, the NPS identifies principal study questions for this phase of the remedial investigation. At SCP, one of NPS' questions for the remedial investigation is to estimate the locations of near-surface radiological contamination as well as surface and subsurface anomalies in waste fill and evaluate

representative locations to determine the source of elevated radioactivity. Similarly, at DHB, one of NPS' questions is to evaluate representative radiological anomalies in waste fill to determine the source of elevated radioactivity.

In Section 5 of each SAP, the NPS describes a combination of one or more of the following field activities at each site to address the principal study questions for radiological contamination: limited coverage GWS, systematic soil sampling accompanied by radiological scanning of cores and boreholes, and/or focused investigation of known elevated anomalies from previous investigations. Based on the findings of previous investigations described in the SCP and DHB SAPs, radium-containing, high-activity artifacts appear to be distributed as discrete items, unlike the distribution of other contaminants at these sites. For instance, artifacts may be distributed such that surface scans or scans of the existing boreholes/trenches conducted by NPS would not identify the artifacts. Thus, it is not clear to NRC staff how the fieldwork described in the SAPs will adequately address the principal study questions regarding the incidental radiological artifacts/contamination given the spatial extent of the waste fill is uncertain, the low likelihood of encountering an incidental radiological artifact/contamination in systematic and judgmental sampling, and the limited coverage of planned radiological surveys and sampling. NPS should describe a conceptual model that assesses risk for known radiological site conditions (i.e., from incidental radiological artifacts/contamination) and align that model with the data quality objectives for surveying and/or remediating the site to ensure NRC's applicable dose criterion will be demonstrated.

Default human health risk- or dose-based screening processes were developed assuming diffuse soil contamination. The conceptual models for these processes do not appear to align with the known conditions at these sites, specifically the presence of small discrete metallic sources of contamination, rather than more widespread, diffuse contamination. Thus, the NPS should also ensure the conceptual model, DQOs, and remedial investigation results are adequate to support future assessments to demonstrate NRC's applicable dose criterion after remedial actions are completed.

Basis: Adequate site characterization is needed to identify and delineate the spatial extent of contamination to support the demonstration that NPS's remedy meets the NRC's dose criterion in either 10 CFR 20.1402, for unrestricted use, or the requirements in 10 CFR 20.1403(b), for restricted use.

> **Response:** NPS agrees that discrete sources of radioactivity are fundamentally different from distributed contamination and that there is a low probability of encountering discrete sources during the collection of systematic soil samples. As summarized in the response to comment #1, NPS intends to perform gamma surveys over 50% of DHB and SCP to inform the selection of judgmental/biased investigations, which are referred to as focused radiological investigations in both SAPs. The approach specified for DHB and SCP is based on the effectiveness of focused radiological investigations in characterizing radiological contamination, including discrete sources, at GKP. As described in the response to comment #1, NPS's RI approach at SCP and DHB is based on generating sufficient data to demonstrate that the CSMs for these sites are the same as GKP (i.e., radiological contamination is associated with waste fill, and wherever waste fill is present, there is a likelihood of encountering radiological contamination). Based on this CSM, the extent of contamination correlates to the extent of waste fill, which will be defined during RI fieldwork. Additionally, our approach is to use a combination of gamma surveys of waste filled areas and focused investigations of radiological anomalies to characterize representative scenarios for radiological contamination in waste fill. NPS is confident that a reduced gamma survey at SCP and DHB (i.e., 50% compared to 100% at GKP) will still be sufficient to detect radiological anomalies and inform the selection of representative locations for focused radiological investigations.
>
> As stated in the SAPs for DHB and SCP, the focused radiological investigations will produce: (1) analytical results for radionuclides in soil at the ground surface and on contact with the recovered source (i.e., uranium-238, radium-226 and thorium-232 via EPA Method 901.1, isotopic uranium and thorium via HASL 300, and gross alpha and gross beta via EPA Method 900), (2) surface count rates at the source of the anomaly, (3) dose rates on contact with the ground surface and 30 centimeters above the ground surface at the source of the anomaly, and (4) physical measurements, a photolog, and a gamma spectrum for the recovered radiological article or source of contamination. This data will inform the RI risk assessments and dose assessments for each site. The investigation approach assumes that radiological contamination is present at or near the ground surface, as was the case at GKP, and can be detected via gamma surveys of the ground surface. For example, the investigations at DHB and SCP could determine that the surface cover is thicker than was observed at

GKP. A thicker cover could shield radiation and limit the effectiveness of surface gamma surveys in identifying radiological contamination. Our investigation approach for both sites will allow us to understand whether refinements to the DHB and SCP CSMs are necessary. NPS recognizes that if the CSMs for DHB and SCP are refined through the planned investigation activities (e.g., thicker cover with possible shielding effects), that additional RI fieldwork, beyond what is described in the RI SAPs, may be required to fully characterize subsurface radiological contamination.

As stated in the response to comment #1, both SCP and DHB were created through historical landfilling operations conducted by New York City and radiological contamination has already been discovered at both sites during limited investigations around paths and accessible areas. NPS is confident that 50% GWS survey coverage along with waste fill delineations will provide sufficient radiological anomalies to further characterize the radiological impacts associated with waste fill at both sites. Also, NPS anticipates that CERCLA response actions will be required to protect human health, achieve federal and state dose limits, and protect the environment prior to reopening any of these sites to the public (i.e., these sites are not being considered for unrestricted release in their current condition). Impacted areas of GKP, SCP, and DHB will remain closed while NPS sequences through the CERCLA process.

ATTACHMENT 1:

Maps Showing Gamma Survey Areas at Spring Creek Park and Dead Horse Bay

Spring Creek Park *Queens, NY*

Gamma Surveys (2017–2023)

- Site boundary
- Gamma Surveys (2017–2023)
- Planned Gamma Surveys
- Access point
- NPS Maintained Fire Road (Pedestrian Access)

N

0 500 1000 ft

0 0.1 0.2 miles

National Park Service
Gateway National Recreation Area

Belt Parkway / Shore Parkway
Ra-226 Deck Marker
Generally Elevated
Rock (Uranium/Radium)
Rock (Thorium)
Rock (Thorium)
Generally Elevated
Rock (Thorium)
Ra-226 Deck Marker
Generally Elevated
Generally Elevated
Generally Elevated
Generally Elevated
Ra-226 Clip
Ra-226 Deck Marker
79th St
80th St
159th Ave
82nd St
85th St
160th Ave
78th St
81st St
83rd St
161st Ave
87th St
90th St
162nd Ave
Shellbank Basin
91st St
Cross Bay Blvd
163rd Ave
86th St
89th St
92nd St
84th St
164th Ave
88th St
165th Ave
The Cove
OLD MILL CREEK

Dead Horse Bay *Brooklyn, NY*

Historical Gamma Survey Coverage

- 2019 Gamma Surveys
- 2021 Gamma Surveys
- 2023 Gamma Surveys
- Site boundary
- City owned
- NPS Trail (No Public Access)

N

0 500 1000 ft

0 0.1 0.25 miles

National Park Service
Gateway National Recreation Area

Northern Portion

Southern Portion

Aviator Golf Center

Moonbeam Gateway Marina

Shell Bank Creek

Belt Pkwy

Shore Pkwy

Old 6-24 Runway

Runway 33

Flatbush Ave

Aviation Rd

Marine Pkwy Bridge

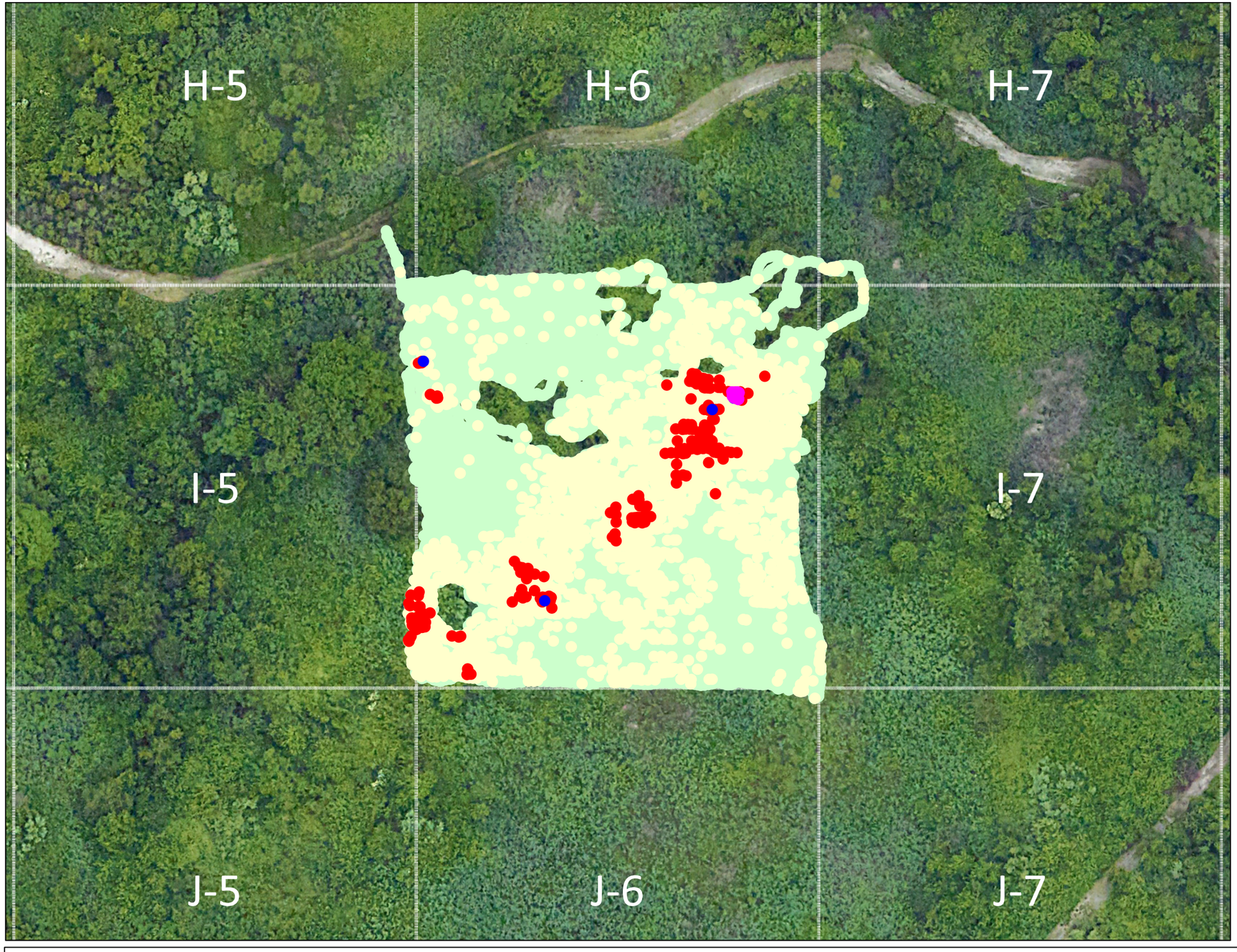
DEAD HORSE BAY

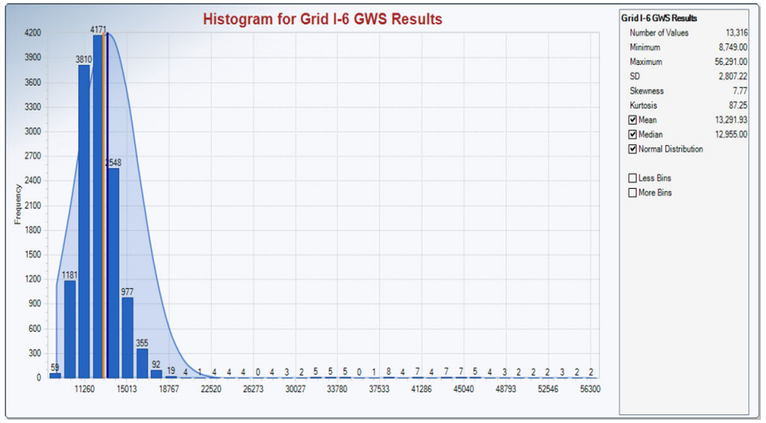
ROCKAWAY INLET

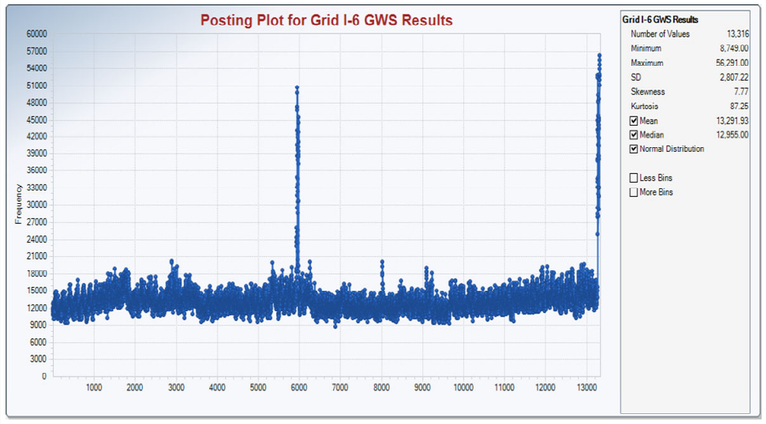
JAMAICA BAY

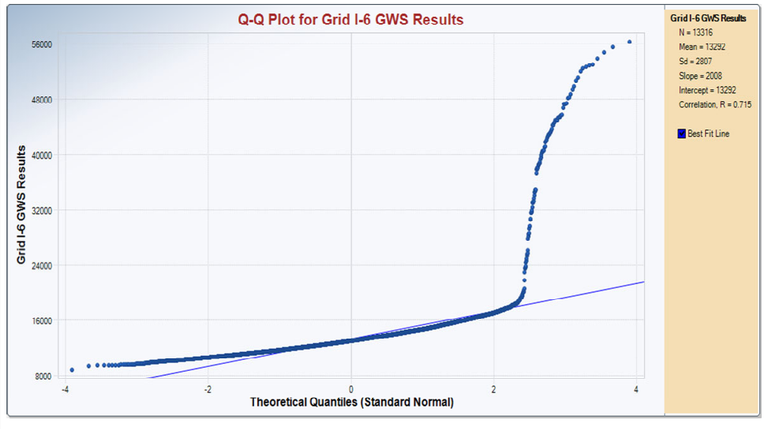
ATTACHMENT 2:

Maps Showing Example Gamma Survey Data Subsets from DHB









Dead Horse Bay Park

Brooklyn, NY

N

Scale in Feet

0 30 60 90 120

Property Boundary

P-18

1-acre Grid

Statistics

Mean	13,291.93
Median	12,955.00
Standard Deviation	2,807.22
Sample Variance	7,880,505.66
Kurtosis	87.25
Skewness	7.77
Minimum	8,749.00
Maximum	56,291.00
Count	13,316.00

Count Rate Ranges

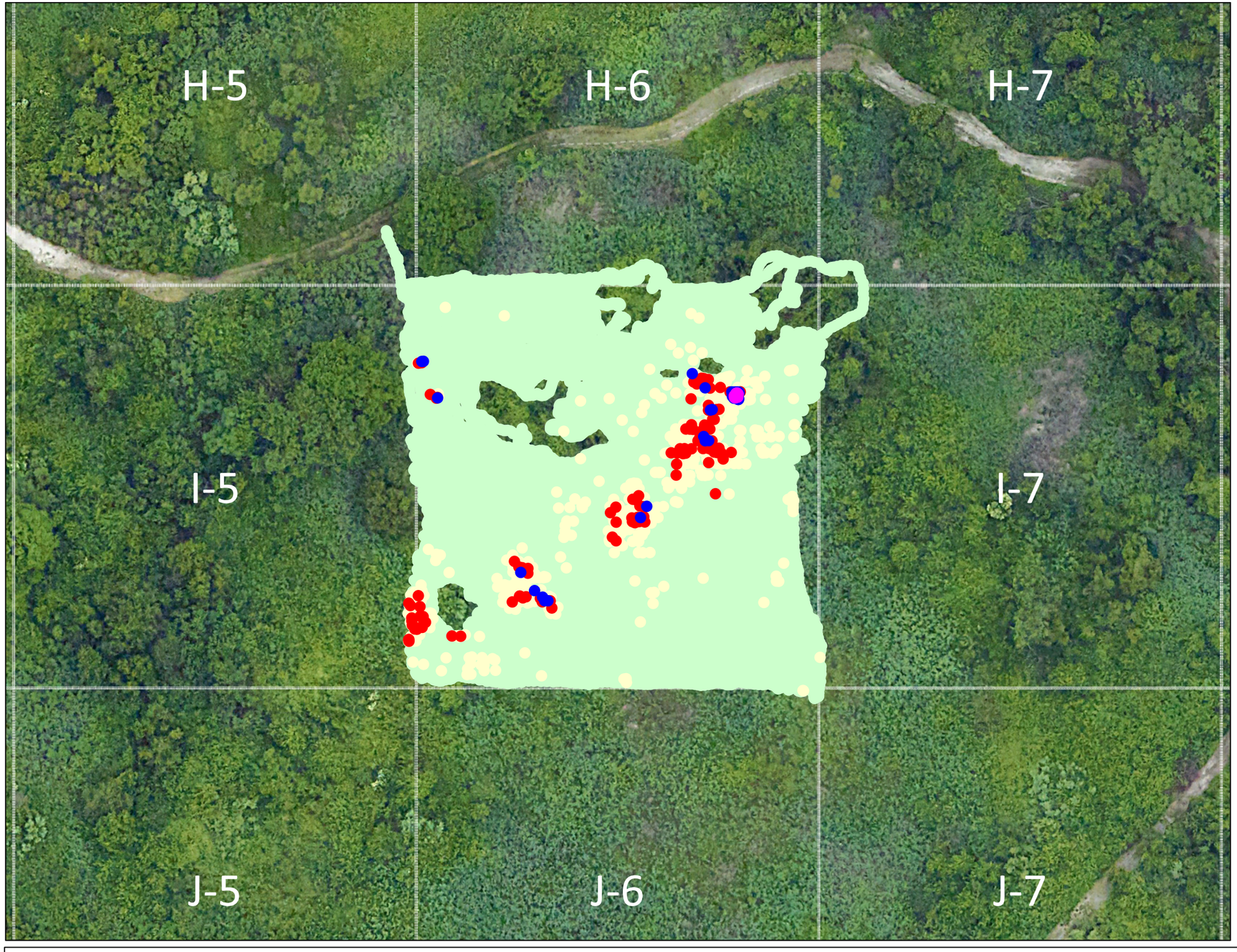
- 8,749 to 14,000
- 14,000 to 17,000
- 17,000 to 20,000
- 20,000 to 22,000
- 22,000 to 60,000

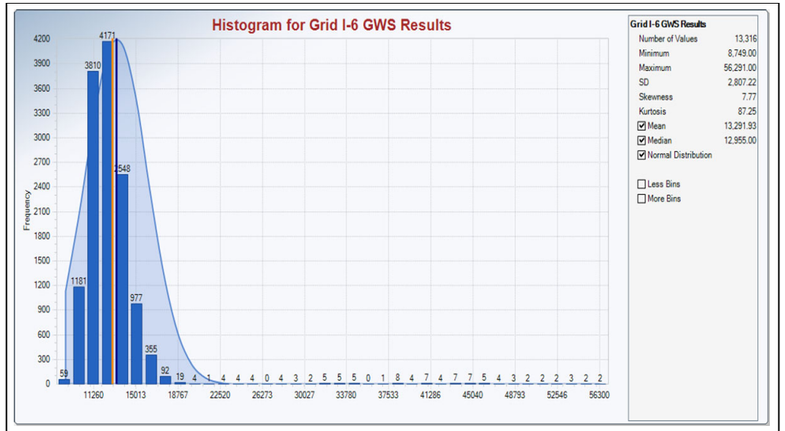
National Park Service
Gateway Recreation Area

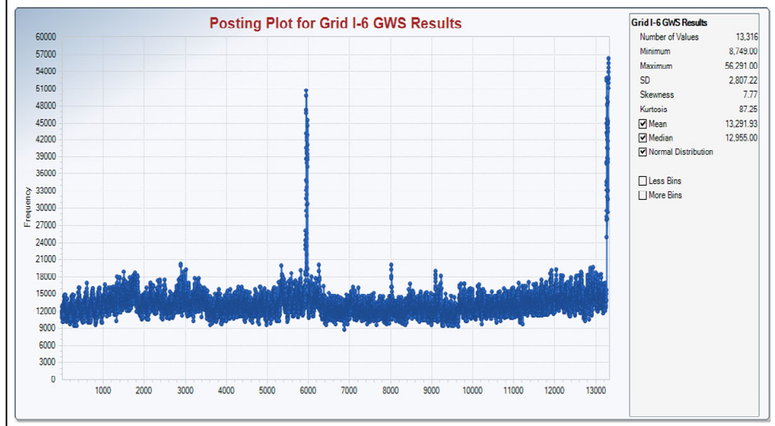
Gamma Radiation Survey

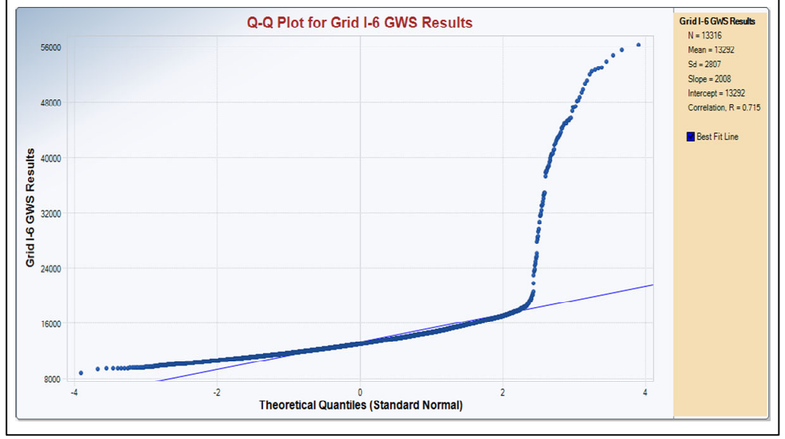
Count Rate Results

Grid I-6









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Zscore Ranges

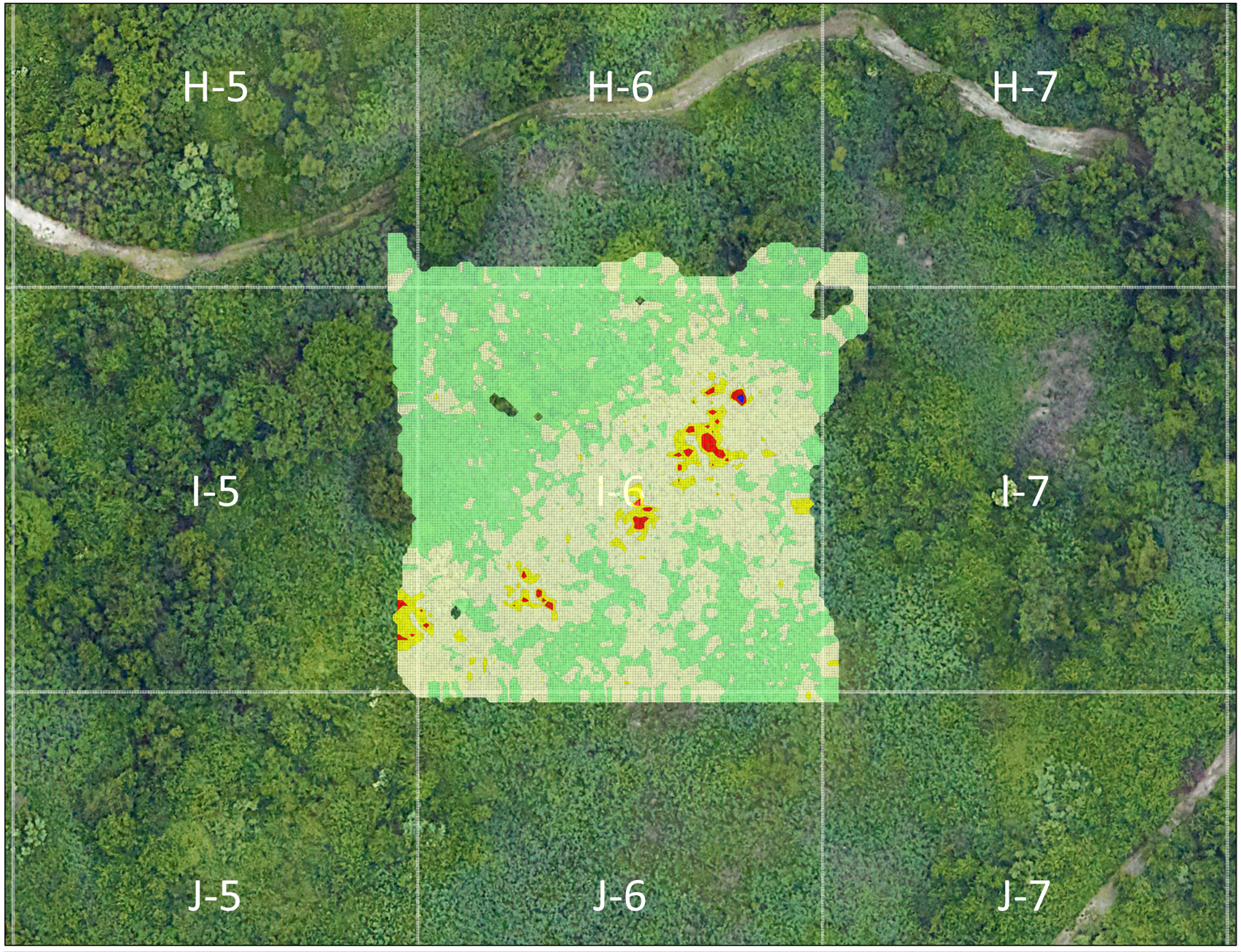
- -3 to 2
- 2 to 3
- 3 to 4
- 4 to 20
- 20 to 30

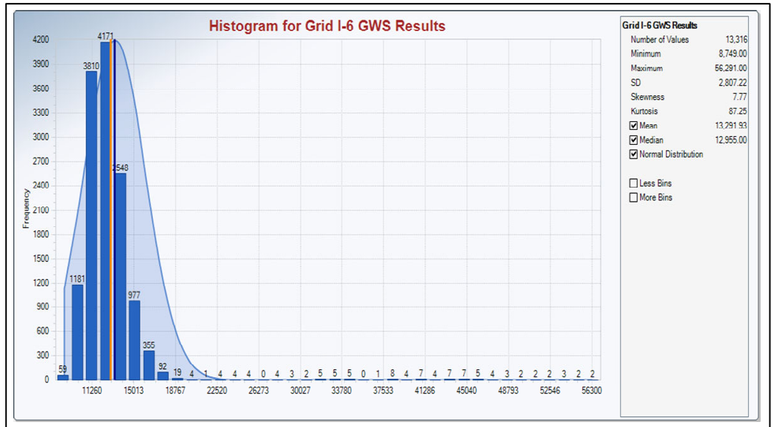
National Park Service
Gateway Recreation Area

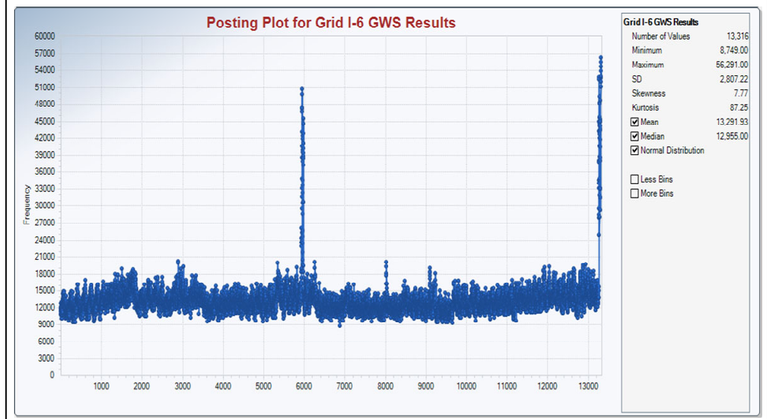
Gamma Radiation Survey

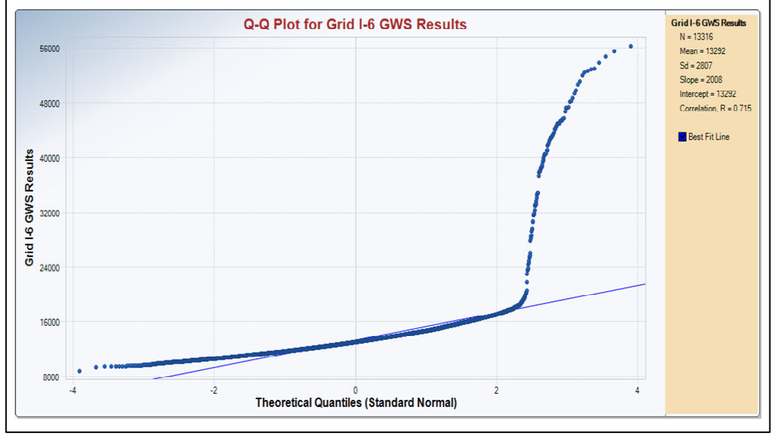
Zscore Results

Grid I-6









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Count	13,316.00

Zscore Ranges

10
3
2
0
-3

National Park Service
Gateway Recreation Area

Gamma Radiation Survey

Contour Results

Grid I-6