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Charlie Catholique, Chair  
Environmental Monitoring Advisory Board  
5006 Franklin, Room 204  
Yellowknife, NT X1A 2P9

29 August 2022

Dear Mr. Catholique:

**Re: Diavik Response to EMAB Recommendations on the 2021 Wildlife Management and Monitoring Report**

Diavik Diamond Mines (2012) Inc. (DDMI) is pleased to submit its responses to Environmental Monitoring Advisory Board's (EMAB) June 29, 2022, recommendations on the 2021 Wildlife Management and Monitoring Report (WMMR) submitted by DDMI on April 1, 2022. DDMI's responses are presented in the attached Table.

If you have any questions regarding this submission, please contact the undersigned at [kofi-boa.antwi@riotinto.com](mailto:kofi-boa.antwi@riotinto.com) or Kyla Gray ([kyla.gray@riotinto.com](mailto:kyla.gray@riotinto.com); (867)-445-4922) at your convenience.

Yours sincerely,



Kofi Boa-Antwi  
Superintendent, Environment

Cc: James Hodson, GNWT-ENR  
[EANorthNWT@ec.gc.ca](mailto:EANorthNWT@ec.gc.ca), ECCC

Attachment: Table 1 DDMI Response to EMAB Comments on 2021 WMMR

**TECHNICAL MEMORANDUM****DATE** 25 August 2022**Reference No.** 21452119-2388-TM-Rev1-5000**DIAVIK WORK PLAN No. 698 Rev. 0****DIAVIK PO No. 3104601458****TO** Kofi Boa-Antwi  
Diavik Diamond Mines (2012) Inc.**CC** Rainie Sharpe (WSP Golder)**FROM** Dan Coulton and John Virgl**EMAIL** Daniel.Coulton@wsp.com;  
John.Virgl@wsp.com**RESPONSES TO EMAB COMMENTS ON DIAVIK 2021 WMMR****1.0 INTRODUCTION**

On 29 June 2022, the Environmental Monitoring Advisory Board (EMAB) provided 33 comments and recommendations from their review of the 2021 Wildlife Management and Monitoring Report (WMMR; WSP Golder 2022) to Diavik Diamond Mines (2012) Inc. (DDMI). The comments provided by EMAB included the review by Management and Solutions in Environmental Science (MSES). Twenty-two of EMAB's comments and recommendations either referred to other 2022 comment identifiers, were not directed to DDMI, or stated that a response was not required. WSP Golder has prepared responses to the 11 remaining EMAB comments in Table 1.

**Table 1: Responses to EMAB Comments on the 2022 WMMR**

2022 Comment Identifier	Category	Comment	Recommendation	DDMI Response
DDMI-WMP-10	Caribou Movement	DDMI provided a discussion clarifying their responses to DDMI-WMP-10 and GNWT-20-WMP-3, stating that GNWT's comment is related to use of an interaction term and EMAB's comment is related to the use of distance zones. DDMI emphasizes the importance of demonstrating the validity of assumptions about the spatial trend in habitat quality. DDMI suggests that two independent studies (ACDC Ltd. 2021 and Golder 2020) that use different methods but arrive at the same conclusion, while demonstrating that their assumptions are valid (spatial trend of habitat quality is not uniformly distributed) provides stronger evidence than two studies by the same researchers (Boulanger et al. 2012; 2021) using the same methods and without verifying assumptions (assumed uniform spatial trend in habitat quality).	For reasons described below (DDMI-WMP-48), we concur with ENR that Golder 2020 is not a conclusive test of ZOIs around the Mine. We note that in the 2021 WMR, DDMI states they will continue ZOI monitoring using alternative methods and data presented by the ZOI Technical Task Group (GNWT-ZOITTG, 2015). It will be helpful to see annual estimates of the ZOI once DDMI begins analyzing the collar data as closure approaches and activity winds down at the site.	ZOI monitoring and analyses are described by Diavik's Tier 3 Wildlife Management and Monitoring Plan (WWMP). DDMI intends to examine annual ZOI patterns following ZOI Technical Task Group guidelines (ZOITTG 2015) based on collared caribou data as part of the 2022 Wildlife Management and Monitoring Report. DDMI will prepare a Tier 2 WWMP that will address monitoring during the closure phase. Annual ZOI estimates from collared caribou data (2009 to 2017) for the Diavik-Ekati mine complex are available in Boulanger et al. (2021). The annual ZOI patterns vary from year-to-year and range from negative (attraction) to positive (avoidance) estimates. In four of nine years a ZOI of avoidance was not detected. The results of Boulanger et al. (2021) indicate that indirect habitat loss is not constant during mine operations as was assumed in the EER (DDMI 1998). The presence of negative ZOIs (attraction) also suggests there are occasional increases in the suitability of habitat adjacent to the mines.
DDMI-WMP-14	Vegetation and Wildlife Habitat	DDMI indicated that they responded to EMAB's comments 17, 18, and 19 on the SW4 Closure Objective during the Wek'èezhii Land and Water Board (WLAWB) review phase of the ICRP version 4.1. Comments 17, 18, & 19 are relevant to Closure Objective SW4: Dust levels do not affect palatability of vegetation to wildlife.	We recommend removing this issue from the WMMR review process and addressing it through the ICRP process.	DDMI agrees that the Diavik Mine Tier 3 WWMP designed for Mine operations cannot address Closure Objective SW4.

DDMI-WMP-14	Vegetation and Wildlife Habitat	<p>The responses provided by DDMI outline a very basic approach to evaluating palatability – “if there is vegetation in an area and caribou are observed using and consuming vegetation then this would mean the vegetation is palatable” (DDMI 2021b).</p> <p>Caribou could be foraging on impacted sites, but not at the same levels as prior to disturbance or at the same level as similar, unimpacted control sites. In order to assess the effectiveness of re-vegetation efforts in creating wildlife habitat, wildlife use of re-vegetated or reclaimed areas must be assessed using a scientifically defensible and repeatable method. A full before-after-control-impact (BACI) is a statistically powerful study design for environmental effects monitoring programs and should be applied, if possible.</p> <p>Formal wildlife species surveys could include approaches such as winter track surveys (relative abundance/density), wildlife cameras (warmer seasons only; abundance and diversity, potentially health; caribou GPS collar location data can complement a camera program), and auditory recording units (warmer seasons only; abundance and diversity). These surveys would target a group of species located in the area at a particular time (e.g., time of day, season, etc.). Data collected through a wildlife use monitoring program for reclaimed sites can also be used to inform future reclamation practices via an adaptive management approach.</p>	<p>Wildlife use of re-vegetated or reclaimed areas must be assessed using a scientifically defensible and repeatable method. All data collected needs to be standardized to ensure comparability between sites and years. Data on dust levels and vegetation abundance/composition should be collected at the same control and impact sites to evaluate factors influencing foraging rates.</p>	
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**Table 1: Responses to EMAB Comments on the 2022 WMMR**

2022 Comment Identifier	Category	Comment	Recommendation	DDMI Response
DDMI-WMP-17	Caribou Distribution	<p>DDMI has already committed to provide range attributes for Bathurst caribou that would provide insight into range fidelity and the correlation of travel routes with seasonal ranges. We agree that this information would reflect cumulative effects from multiple overlapping developments that occur in the caribou range. Both parties are in agreement that future environmental assessments may require energetic analysis.</p> <p>The original migration predictions are based on a least-cost path (friction) analysis. In hindsight, this component of the monitoring program probably should have been set up to evaluate changes in the cost of movement for caribou migrating past the Diavik Mine. Based on the results of the energetic analysis completed for the Jay Project, we could assume that impacts from the Diavik Project would decrease caribou fecundity by &lt;0.3%. Diavik provided additional insight to the Jay analysis that suggests the analysis was quite conservative and that there is likely no measurable energetic effect. We are not familiar with the details of that analysis and cannot comment further on it.</p>	<p>Can DDMI propose an alternative approach to monitoring change in caribou migration patterns that could be specifically linked to Diavik Mine activities? Using collar data, could seasonal migration travel routes be evaluated post-closure to evaluate whether the removal of human activity and infrastructure at the Diavik Mine site results in changes to migration travel routes from those observed during Mine operations? This information could potentially be used to information future development activities and impact predictions.</p>	<p>DDMI has used Bathurst caribou collar data (1996 to 2018) to assess east-west deflection of caribou movements (migration routes) during the northern and southern migration (Golder 2020a). The conclusion from long-term results is that the Diavik Mine has not had a strong influence on caribou northern or southern migration patterns during construction and operation, which has led to the discontinuation of this monitoring. DDMI has acknowledged that the use of East Island by migrating caribou during baseline has discontinued since Diavik Mine construction and during operation. Closure of Diavik Mine will not remove all human activity from the Lac de Gras region. The adjacent Ekati mine will continue to operate after Diavik mine is closed making it problematic to assign any change or lack of change in caribou migration routes explicitly to Diavik Mine.</p>

**Table 1: Responses to EMAB Comments on the 2022 WMMR**

2022 Comment Identifier	Category	Comment	Recommendation	DDMI Response
DDMI-WMP-17	Caribou Distribution			<p>Spatial and temporal patterns of caribou distribution should reflect changes in travel routes by migrating caribou at coarse scales but not particular routes.</p> <p>It is possible to assess changes to migration routes at the level of individual collared caribou (e.g., Poole et al. 2021), which is different than population-level patterns and the scale of the EER (DDMI 1998) and effects monitoring (DDMI 2021) by Diavik Mine. An additional consideration for EMAB's proposed analysis would be the timing of the assessment during post-closure. Variation in seasonal range sizes and location over time demonstrate that caribou herd size influences the migration routes of individuals (Virgl et al. 2017; Golder 2020a). The Bathurst caribou herd began declining during baseline years (since mid-1980s [Virgl et al. 2017]) for Diavik Mine, with population cycles estimated to be 40 to 60 years (Zalatan et al. 2006). This type of influence would need to be addressed in order to strengthen inferences for the proposed comparison.</p>

**Table 1: Responses to EMAB Comments on the 2022 WMMR**

2022 Comment Identifier	Category	Comment	Recommendation	DDMI Response
DDMI-WMP-48	Caribou Movement	<p>DDMI reiterated their view that two independent studies (ACDC Ltd. 2021 and Golder 2020) that use different methods but arrive at the same conclusion, while demonstrating that their assumptions are valid (spatial trend of habitat quality is not uniformly distributed) provides stronger evidence that two studies by the same researchers (Boulanger et al. 2012; 2021) using the same methods and without verifying assumptions (assumed uniform spatial trend in habitat quality). The distribution of preferred habitat quality is an important assumption for the type of analysis DDMI did, which was simply a regression analysis to explain patterns in caribou abundance using different environmental variables. Habitat selection is inferred, not measured directly in such an analysis. Habitat selection is also inferred in the ACDC Ltd report because aerial survey methods do not lend themselves to exact location data on caribou, so it is impossible to identify exactly what habitat a caribou is using at any given time (Boulanger et al. 2021) directly measured habitat selection by comparing used to available habitats at different distances from the mines. In our opinion, Boulanger et al. (2021) do not need to make assumptions about the distribution of preferred habitat because they are directly estimating habitat selection by comparing the conditions at each location used by caribou to the conditions at random locations. In our opinion, Boulanger et al.'s (2021) analysis accounts for the distribution, and avoidance of large water features by caribou, on the landscape in both their base habitat selection model and the ZOI analysis.</p>	<p>Considering all of the information available to us at this point in time, we recognize that a ZOI exists for caribou around the Diavik diamond Mine and recommend all future efforts be focused on developing and implementing mitigation measures to counter this impact to caribou.</p> <p>We re-iterate our recommendation: DDMI, in collaboration with GNWT, should immediately develop monitoring techniques to identify Mine-related sources of sensory disturbance and new methods for monitoring caribou abundance and distribution relative to the Mine whenever they are in the area.</p>	<p>Please refer to the response DDMI-WMP-10 for annual caribou ZOI patterns from the most recent ZOI analyses for the Diavik and Ekati mines (Boulanger et al. 2021a). To date only statistical effects have been demonstrated and that there is yet to be evidence of ecological effects or demographic consequence from mining. Ecological effects analysis was completed by Plante et al. (2020) who found no reduction in caribou survival related to interactions with industrial disturbances by the Leaf River and George River caribou herds. Similarly, Golder (2020b) showed that Lorillard collared caribou interacting with Meadowbank mine road ZOIs reached calving areas and showed similar parturition timing, calving rates and neonate mortality rates as reference caribou despite conclusions of statistical ZOI effects from the same collar data (Boulanger et al. 2020).</p> <p>The studies of Golder (2020) and ACDC (2020) identified available preferred and selected habitats based on results from use-availability (resource selection function [RSF]) analyses of collared caribou (e.g., Johnson et al. 2005; Boulanger et al. 2012). Preferred and selected habitats were then applied to the analysis of aerial survey data. Boulanger et al. (2012, 2021) also identified selected habitats from the same collared caribou data and applied the results of their RSF to the analysis of aerial survey data. The application of selected habitats for analysis of aerial survey data was the same for all studies. All four studies (Boulanger et al. 2012, 2021; ACDC 2020; Golder 2020) used the same aerial survey data so any location error is present in these studies and within the 1.2 km<sup>2</sup> sampling unit.</p>

DDMI-WMP-48	Caribou Movement	<p>In our opinion, given that DDMI's and ACDC Ltd.'s analyses look only at the aerial survey data and lack direct measures of habitat selection, there is insufficient reason to discount the findings of Boulanger et al. (2021), which has also been through the peer-review process. Given the current state of the Bathurst caribou population, we recommend a precautionary approach to caribou management.</p> <p>DDMI identified the following Mine activity covariates that are monitored and have been evaluated: fugitive dust deposition, number of flights and blasts, waste rock hauled and full-time equivalents. DDMI reported that no significant relationship to wildlife monitoring data was found. DDMI concludes that many lines of evidence show no response or a weak response by caribou to sensory disturbance.</p>		<p>A more direct way to test whether selection of habitat(s) changed with proximity would have been to include an interaction term between distance and habitat variables in the RSF model. By doing so, it would have tested whether the odds of selection changed as a function of distance while controlling for the availability of different habitats (Jaccard 2001). Boulanger et al. (2012, 2021) did not include this type of interaction in their RSF. DDMI agrees that Boulanger et al. (2012, 2021) accounts for the selection of large water features but disagrees that these studies account for a change in selection of large water features relative to different distances to Diavik and Ekati mine. Accounting for the change in selection would require the inclusion of an interaction between distance and habitat variables (e.g., large water features). Failure to include an effect for distance in base habitat models would assume all patches of the same habitat type are selected equally regardless of where they occur even though the context of availability has changed. It would be analogous to saying that heath tundra on an island in Lac de Gras (without a mine) is as likely to be selected as patches on the mainland even though the island patch is surrounded by water, which caribou avoid.</p> <p>Sources of sensory disturbance that are monitored at Diavik Mine include fugitive dust deposition, full-time equivalents, number of flights, number of blasts and waste rock hauled (Golder 2017), which have been included in comprehensive analyses (e.g., Golder 2017, 2020). A new study design/sampling method for monitoring of caribou abundance and distribution is not necessary because caribou collar data are available and can be used to estimate caribou ZOIs (Johnson et al. 2005; Boulanger et al. 2012, 2021a; ZOITTG 2015).</p>
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**Table 1: Responses to EMAB Comments on the 2022 WMMR**

2022 Comment Identifier	Category	Comment	Recommendation	DDMI Response
DDMI-WMP-54	Wolverine	<p>DDMI reiterated the decision to discontinue wolverine hair snagging made at the February 2021 Diamond Mine Wildlife Monitoring Meeting. DDMI suggests that wolverine snow track monitoring is sufficient to understand trends in wolverine abundance because trends in occurrence from the wolverine snow track monitoring program corresponded with trends in abundance for the hair snagging program. They use a reference to a 2007 DDMI report on monitoring methods, which we don't have on file and so could not review. They also included a figure with their responses showing the correspondence between hair snagging and snow track monitoring estimates. No information on how the 'correspondence' was estimated was provided in DDMI's response.</p> <p>It is impossible to confirm predictions about wolverine presence and altered population parameters without the existence of a program such as the hair snagging program.</p>	<p>To have a clearer understanding of potential wolverine population trends, as inferred by snow track occurrence, we recommend producing a figure annually in the WMMR that is similar to the one provided by DDMI in its' response, in order for reviewers to easily note potential population trends by demonstrating the temporal trend in occurrence estimates.</p> <p>We recommend EMAB discuss regional wolverine population trends with ENR and what, if any triggers they have to undertake another round of regional DNA-based population surveys.</p>	<p>Correspondence concluded from Figure 2 (Golder 2021) was qualitatively assessed from similar temporal trends (measured in the same years) between snow track monitoring designs (IQ = Inuit Qaujimagatuqangit, SRS = simple random sampling) and hair-snagging results (DNA = hair snagging). Figure 2 included demarcation of values included in correspondence determination.</p> <p>The requested figure will be included in annual reports. Direct mine-related wolverine mortalities at Diavik continue to be infrequent (WSP Golder 2022), which is a key driver of population demography. Hair snagging is not necessary to determine presence. Snow track counts provide more than presence; the current design (two rounds) provides detection rate and relative abundance.</p> <p>DDMI will provide another copy of the DDMI (2007) to distribute to MSES.</p>
DDMI-WMP-58	Vegetation and Wildlife Habitat	<p>In 2021, the changes in landcover were associated with losses of heath tundra (0.07 km<sup>2</sup>), heath boulder (0.02 km<sup>2</sup>), heath bedrock (0.01 km<sup>2</sup>), and tussock/hummock (0.04 km<sup>2</sup>) classes in the Ecological Landscape Classification (ELC). We noted a potential typo in Section 3.2 and Table 2, it appears as though the heath boulder class is incorrectly titled the health boulder class in the text and table.</p>	<p>Please revise the text and table as necessary. In addition, please clarify what type of satellite imagery is used in this analysis as it provides an understanding of the data resolution used in the landscape analysis. Otherwise, the methods applied for this part of monitoring are adequate.</p>	<p>Thank you for identifying misspellings of "heath" in the 2021 WMMR. A SPOT satellite Image was used in Landscape Change analysis. The resolution of the imagery is 150 cm.</p>

**Table 1: Responses to EMAB Comments on the 2022 WMMR**

2022 Comment Identifier	Category	Comment	Recommendation	DDMI Response
DDMI-WMP-60	Caribou Movement	<p>No new data on caribou movement was presented, and no additional analyses for ZOI monitoring were completed, for the 2021 WMMR. DDMI provides a brief synopsis of Golder 2020 and ERM 2021, two analyses of the aerial survey data that were used to suggest there was no ZOI around the mines. They point out that this result contradicts the findings of Boulanger et al. (2012 &amp; 2021). No further discussion is applied. We have noted in previous reviews why we disagree with the conclusions of Golder 2020, and in their review of the 2020 WMR, ENR stated they do not consider Golder 2020 a conclusive test of the ZOI around the mines. DDMI indicates they will continue monitoring the ZOI using methods and data presented by the ZOI Technical Task Group. Based on statements in previous WMRs, we are expecting DDMI to report on their new approach to ZOI analysis in the next Comprehensive Wildlife Monitoring Report in 2023.</p>	<p>Following that, we recommend including annual estimates of the ZOI size in order for EMAB to monitor how it changes through Mine closure and reclamation on shorter time scales rather than waiting for the Comprehensive Wildlife Monitoring Reports every third year.</p>	<p>Please refer to response DDMI-WMP-10. As ZOI monitoring does not inform Diavik Mine operations, ZOI estimates will not be provided in annual reports but follow the schedule identified in the WMMR (DDMI 2021).</p>
DDMI-WMP-65	Caribou Deterrence	<p>If caribou are present in hazardous areas, such as the airport or blast areas, active deterrence (slow herding) is used to move caribou away. In 2021, there was one use of active deterrence when a caribou was observed on the south haul road. Traffic control measures were implemented, Environment Department staff prevented the caribou from returning to the road. Mitigations were successful and the caribou moved away from the haul road.</p>	<p>Active deterrence is not required every year; however, when it is reported, it would be helpful if the results included one statement placing them in historical context (e.g., When was the last time it was used? How frequently has it been deployed over the years?). Otherwise, the methods applied for this part of monitoring are adequate.</p>	<p>Historical context of active deterrence for caribou will be provided in the 2022 WMMR.</p>

**Table 1: Responses to EMAB Comments on the 2022 WMMR**

2022 Comment Identifier	Category	Comment	Recommendation	DDMI Response
DDMI-WMP-66	Caribou Adaptive Management	<p>The 2021 WMMR includes a section where DDMI outlines adaptive management measures they are introducing or recommendations for the upcoming monitoring year. In response to ENR-WMMP-02 (DDMI 2021, Appendix C, Table 2), DDMI has included additional mitigation measures in the 2021 WMMP that are specific to caribou, including caribou detection, action levels, tiered mitigation, and blasting. DDMI provides a high-level description of some of these mitigation measures. We reviewed the relevant portions of the latest version of the WMMP (i.e., Table 4.1-1, pg. 4-3) and found the additional mitigation details generally useful for understanding how caribou mitigation and monitoring will occur when caribou are in the region. DDMI identified four action levels, defined based on timing (i.e., actions taken throughout the year) or the proximity of caribou to mine infrastructure. We note that for each level DDMI proposes a few monitoring actions. Behavioural scans on observed caribou are a recommended measure throughout the year, and when caribou are sighted on east island or on other mine areas or roads. However, behavioural scans are not included as part of the monitoring when collared caribou are within 5 km of east island.</p>	<p>Please discuss why behavioural scans are not included as part of the monitoring, even in cases when caribou are incidentally observed within 5 km of east island.</p>	<p>Section 4.3.2 of the 2021 WMMR indicates that group behaviour scans were completed on 21 caribou groups that were incidentally detected, ranging from 0 km to 15 km from Diavik Mine. In cases where caribou are incidentally detected beyond visibility from the Mine site (e.g., &gt;2 km), group behaviour scans may be recorded if the staff present are familiar with group scan methods and it does not detract from achieving the objective of the off-site work. Beyond visibility from East Island, DDMI wants to avoid traveling to caribou groups to perform scans and potentially introduce caribou to stressors (e.g., snowmobiles). As noted previously to EMAB, winter represents a time with extreme cold temperatures and wind chill and limited daylight hours that increase human health and safety risks. DDMI will not complete this monitoring when it deems it is not safe to do so.</p>
DDMI-WMP-70	Raptors	<p>Mine-related incidents and raptor mortalities are reported through incidental reports from Mine staff. In 2021, two raptor mortalities were reported: a dead rough-legged hawk near the south entrance to the A21 pit, and a dead short-eared owl on the road between the airport and the north inlet water treatment plant. Due to their proximity to Mine-related roads, it is assumed both deaths results from collisions with vehicles.</p>	<p>The methods applied for raptor monitoring are adequate, no further recommendations. However, we recommend developing a figure showing the number of Mine-related incidents and mortalities by year in each future monitoring report. This will allow for easy interpretation of mortality trends over time and should be easy to update each year.</p>	<p>A figure showing annual Mine-related raptor mortalities will be included in the 2022 WMMR.</p>

**Table 1: Responses to EMAB Comments on the 2022 WMMR**

2022 Comment Identifier	Category	Comment	Recommendation	DDMI Response
DDMI-WMP-72	Comprehensive Vegetation and Lichen Analysis Report	In general, the vegetation data indicated there were differences in species abundance and community composition over time “likely due to Mine-related effects, such as dust deposition.” (Golder 2022, Appendix N, pg. 21). DDMI recommendations include continued monitoring of dust deposition and vegetation plots; however, it is unclear what is being done to mitigate the impacts of dust deposition on plant communities.	Can DDMI please discuss what, if any mitigation measures are being used to reduce levels of dust deposition? Can DDMI also please discuss if any non-native plant species have been found in any of the monitoring plots?	<p>The Tier 3 WMMP for Diavik identifies several mitigations to reduce fugitive dust deposition. These include use of dust suppressants, low speed limits and a small footprint. Additionally, the use of underground mining techniques has reduced fugitive dust.</p> <p>Non-native plants were not observed at monitoring plots in 2021 and have not been observed previously.</p>

## 2.0 CLOSURE

We trust that this technical memorandum meets your current requirements. Please contact the undersigned if you have any questions or concerns.

**Golder Associates Ltd.**

**Original Signed by**

Dan Coulton, Ph.D., RPBio.  
Senior Wildlife Biologist

DWC/JV/rd

**Original Signed by**

John Virgl  
Senior Principal Ecologist

### Disclaimer

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