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Nitrogen Deposition in Built Development: Balancing Construction with Environmental Regulations

The Legal and Environmental Constraints in Project Approvals under Wet Natuurbescherming

MSc Thesis

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1. Abstract

Nitrogen deposition is a growing concern in the Netherlands due to its impact on Natura 2000 areas and its restricting effect on built environment development. This division makes it challenging for municipalities to find a balance between nitrogen reduction and built environment development. This study analyzes 390 approved nature permits to assess how decision-making bodies handle nitrogen regulations under the ‘Wet Natuurbescherming’ while promoting built development. This was evaluated using a classification system based on ‘suspicion levels’, which indicate, based on specific criteria, why nature permits are considered suspicious. The results show that municipalities systematically grant permits that avoid stricter assessments to rule out negative impacts on Natura 2000 areas. Additionally, incomplete nitrogen calculations and strategic assumptions obscure the actual nitrogen impact, with long-term nitrogen deposition often being disregarded. Due to the applied suspicion levels, it becomes evident that there is a need for stricter oversight with a standardized and transparent nitrogen assessment method to establish an equilibrium between new built environment development and nitrogen reduction.

2. Contents

3. Introduction

The Netherlands emitted over 17.0 kilograms of nitrogen oxides (NOx) per hectare per year in 2021, which is the second highest in the entire European Union, after Malta (Ministerie van Volksgezondheid, Welzijn en Sport, n.d.-b). These emissions originate from agriculture, mobility, industry, foreign sources, and other sectors, including the built environment development. The NOx and NHy (NH3 and NH4) that settle from the air onto plants and soil are referred to as nitrogen deposition (Marra et al., 2022). Excessive nitrogen deposition is harmful to vulnerable natural areas, as it negatively impacts the quality of groundwater and surface water, biodiversity, and the health of people in the Netherlands (Ministerie van Volksgezondheid, Welzijn en Sport, n.d.-a).

Despite the high N emissions, nitrogen deposition in the Netherlands has been decreasing since 1990 (Marra et al., 2022). However, in 2019, the Council of State reviewed the European regulations on nitrogen deposition and determined that nature needed better protection (Ministerie van Volksgezondheid, Welzijn en Sport, n.d.-b). In 2021, the "Wet stikstofreductie en Natuurverbetering" (Wsn) was adopted. The Wsn is intended as new legislation to promote nitrogen reduction in Natura-2000 (N2000) areas, with a legally established goal that by 2035, at least 74% of each N2000 area must be below the "Kritische Depositiewaarde" (critical threshold) (Marra et al., 2022). With the adoption of the Wsn, the earlier provision for permit-free projects with a deposition value of <0.05 mol N/ha/year was eliminated. Now, any project with nitrogen deposition of ≥0.005 mol N/ha/year must apply for a permit under the "Wet Natuurbescherming" (Wnb) and the Wsn (Gemeente Eindhoven, 2020). With the introduction of the Wsn and Wnb, it has become more difficult for built environment development to obtain a permit, as the standard for nitrogen deposition has been significantly lowered. Despite this challenge, the Dutch government aims to build 900,000 homes by 2030 to address housing shortages (Rijksoverheid, 2022).

The question is not whether new built environment development increases nitrogen deposition, but how municipalities handle the tension between the built environment development and limited nitrogen space. If agricultural emissions were reduced, this issue would be less pressing, but political inertia in that department leaves municipalities with difficult choices. This challenge is further compounded by local governments that rely on revenue from property taxes in the Netherlands (Götze & Hartmann, 2021), which can be increased through new built environment development. Additionally, municipalities have more autonomy to grant permits under the 2024 Environmental Act (Van der Weijde, 2023). Combined with pressure to meet housing targets and limited knowledge of evolving nitrogen policies, municipalities may take actions that prioritize the built environment over environmental impacts, raising suspicions about the integrity of the permitting process in balancing the built environment development and nitrogen reduction. This is especially relevant after the very recent Council of State's decision to no longer allow internal offsetting (Raad van State, 2024), which also affects previously granted permits.

The aim of this research is to investigate how often municipalities grant permits for new built environment development projects that are questionable from the perspective of the Wnb and Wsn, and the reasoning behind the decisions. This includes examining which spatial factors influence the permitting process. The research question is therefore:

How do decision-making bodies approach the granting of permits for new built environment development projects, given the suspicion about the balance between built development and nitrogen reduction?

This is being studied by examining the province of North Holland as this province has been tasked with building approximately 180,000 new homes by 2030 (Ministerie van Algemene Zaken, 2023), while also reducing nitrogen deposition in the surrounding 14 N2000 areas. To meet these two objectives, the province of North Holland follows the 'Schoon en Emissieloos Bouwen' roadmap (SEB, 2023). Aiming to contribute through the 'Handreiking Stikstofvrije Woningbouw', which presents various integrated measures to reduce nitrogen emissions from construction materials (Groet et al., 2020). In addition, the province needs to improve its nature, which will be done through the 'Provinciaal Programma Landelijk Gebied' that has been in place since 2024 (provincie Noord-Holland, 2023).

To answer the main research question, three sub-questions have been formulated, each addressing a specific component of the ‘suspicion levels’. These levels reflect concerns about the balance between built development and nitrogen reduction, assessing to what extent permits for new built environment development projects may be at risk of non-compliance with nitrogen regulations:

Sub-question 1: Level of suspicion: How can new built environment development projects be characterized in terms of suspicion level?

Sub-question 2: Nature permit: What are the reasons for granting nature permits under the Wet Natuurbescherming per suspicion level?

Sub-question 3: Spatial and decision-making influence: What is the influence of spatial factors and decision-making bodies on the prevalence of suspicion levels in new built environmental development projects?

4. Theoretical Framework

The theoretical framework explains the main concepts of this thesis. The first key concept is nitrogen deposition and the current effects of nitrogen deposition that are released from built environment development projects. Additionally, initial insights are provided into the current legislation and policies in the Netherlands regarding adjustments in built environment developments due to nitrogen deposition. This part will also offer insights into the role that municipalities play in granting permits. Finally, the suspicious criteria for new built environment development projects are explained by the level of suspicion.

4.1. Impact of nitrogen deposition from built environment developments on Natura 2000

Nitrogen deposition from sectors including the built environment development causes soil acidification in nutrient-poor soils, displacing nutrient-poor plants and reducing biodiversity in nature areas (Cell et al., 2020). To assess whether nitrogen deposition affects a habitat type within an N2000 area, a critical threshold has been established. With a persistent and high exceedance of the critical threshold, the likelihood of undesirable effects on biodiversity will be higher (Wamelink et al., 2023). Research shows that habitat loss occurs when nitrogen deposition remains or exceeds 20 mol N/ha/year or more, with further species decline occurring at 35 mol N/ha/year, especially when the background deposition is near the critical treshold level (Cardinaals et al., 2019). The values at which a habitat type is considered sensitive to nitrogen are illustrated in Table 1, ranging from very sensitive to non-sensitive according to the 'Wet Ammoniak en Veehouderij' (WAV) sensitivity class (Wamelink et al., 2023).

Table 1: Translation of the critical treshold per habitat type to the Wet Ammonia ken Veehouderij (WAV) sensitivity class, with a very sensitive habitat type of <1400 mol N/ha/year, a sensitive habitat type of 1400-<2400 mol N/ha/year, and a non-sensitive habitat type of >2400 mol N/ha/year. The following conversions are used: 1 kg N = 71.43 mol N and 1 mol N = 0.014 kg N. (Wamelink et al., 2023).

zeer gevoelig	<20	<1400
gevoelig [1]	20 - <34	1400 - <2400
minder/niet gevoelig	≥ 34	≥ 2400

On a national level, nitrogen deposition amounts to over 1378 mol N/ha/year, of which 361 mol N/ha/year consists of NOx. The amount of NOx is lower than that of ammonia (NH3) (Ministerie van Volksgezondheid, Welzijn en Sport, n.d.-c). Since agriculture (primarily NH3) contributes the most to the total nitrogen deposition in the Netherlands, accounting for over 46% of total nitrogen deposition (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2024). To assess the contribution of built environment development, nitrogen deposition from both the construction phase and the operational phase is examined. This includes the deposition from the machinery used during the construction and transportation movements. 6.7% of nitrogen deposition comes from households, services, and construction, with the construction sector contributing 0.6%. The other emissions from built environmental development projects originate from road traffic (Cardinaals et al., 2019). Road traffic alone accounts for approximately 6.1% of the total nitrogen deposition and mobile machinery for 1%, which can be seen in Figure 1 (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2024).

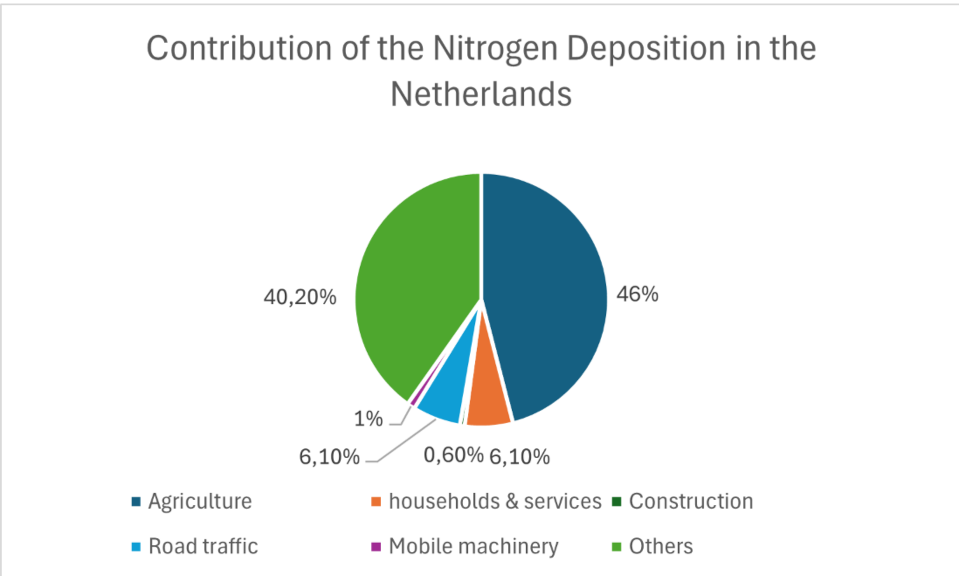

Figure 1: The contribution of nitrogen deposition in the Netherlands from all sectors, expressed in percentages. Agriculture is the largest contributor, accounting for over 46%. Road traffic and households both contribute 6.1%. The contributions from mobile machinery is 1% and construction 0.6%. All other sectors collectively contribute 40.2%(Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2024).

4.2. Policies and legislation relating to nitrogen deposition in built environment development

To protect plant and animal species in N2000 areas, the Environmental Act has been established. This Environmental Act is based on the legislation of the Wnb to conserve various plant and animal species, including vulnerable species. The Environmental Act outlines the measures that the national government and the provinces must implement to protect nature. However, the provinces are allowed to determine their own nature policies and how they carry out these measures (Ministerie van Algemene Zaken, 2024-b). In addition to the Environmental Act, the Wsn came into effect in 2021. A component of the Wsn was the exemption for construction, demolition, and one-time development activities (construction exemption). This construction exemption means that the nitrogen deposition occurring during the construction phase was no longer considered in the permitting process and could be granted without a permit. Only the nitrogen deposition from the operational phase was assessed. Since the share of nitrogen emissions from construction was deemed relatively small, this allowed construction projects to proceed (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2021). However, the Council of State has ruled that a construction exemption can no longer be used. Construction, demolition, and one-time development are considered temporary activities, and for these types of projects (where it is clear at what exact time the project will be completed), a nature permit must be applied (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2021).

Figure 2 presents the decision tree under the Wnb for obtaining a nature permit. Figure 2 illustrates five possible steps that determine whether a permit can be granted, the first of which is to map the nitrogen deposition from both the construction phase and the operational phase of the project. A nitrogen calculation must be made using the statutory calculation of Aerius. Aerius, which has been in use since 2015, is a calculation tool that supports the granting of permits under the Environmental Act (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2024).

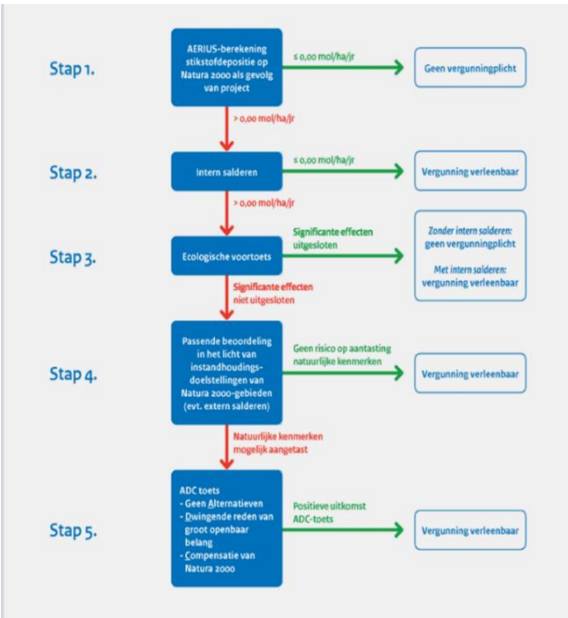

Figure 2: The step-by-step plan under the Wet Natuurbescherming. The 5 steps and instruments can be used to qualify for a nature permit. Step 1: Aerius calculation. Step 2: Internal offsetting. Step 3: Ecological screening. Step 4: Detailed ecological impact assessment and external offsetting. Step 5: An ADC assessment, with the obligation to have no alternative, compelling reasons of public interest, and compensation for Natura 2000 (Rijksoverheid, n.d.)

Collected information on nitrogen emissions from both the construction and operational phases, the total nitrogen deposition of the project can be calculated. If nitrogen deposition is <0.005 mol N/ha/year, no nature permit is required. If this is not the case, internal offsetting can be considered. Internal offsetting involves checking whether nitrogen deposition does not increase compared to the current phase (prior to the construction and operational phases). Internal offsetting is valid, for example, when nitrogen deposition already occurs, because the current function of the land is an agricultural one, and no increase in deposition is assumed for the new built environmental development. If this is not the case, an ecological screening must be conducted. Despite the project leading to an increase in nitrogen deposition, the ecological screening can rule out negative effects. The conservation status of the relevant habitat type is prioritized in this assessment. If a nature permit has not been granted after the ecological screening, this indicates a risk of significant effects. To obtain a permit a detailed ecological impact assessment is required. In a detailed ecological impact assessment, it is evaluated whether the natural characteristics of N2000 areas are affected and whether compensation and mitigation measures are necessary. External offsetting may also be considered as a way to obtain a nature permit through a competent authority. With external offsetting, the positive effects of other projects are weighed against the effects of the specific project. If negative effects on a N2000 area are unavoidable, the ADC assessment can still be applied. The ADC assessment requires that the project has an imperative reason of overriding public interest, that the damage is compensated by creating new nature, and that no other alternatives are possible. If all these conditions are met, a nature permit can still be granted (Rijksoverheid, n.d.).

In addition to the five possible steps shown in Figure 2, decision-making bodies can use a guideline that is not legally binding. This guideline is designed to determine how far small-scale housing developments have to be situated from N2000 areas for the nitrogen deposition to remain under the threshold of 0.005 mol N/ha/year. This is determined by means of the effect distance. The effect distance is defined by the nitrogen emissions and the distance from a new built environmental development project to a N2000 area within which nitrogen deposition remains <0.005 mol N/ha/year and therefore has no significant negative effect (Cardinaals et al., 2019). An example is shown in Figure 3. The calculations used to determine the effect distance can be found in Appendix 1.

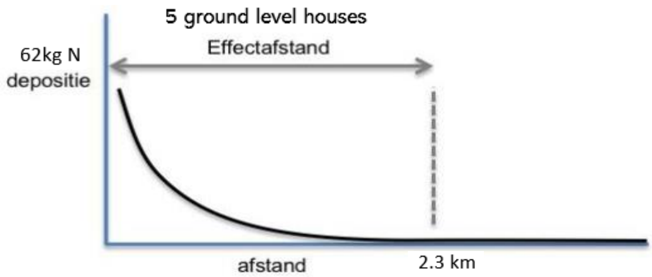

Figure 3: An illustration of the relationship between nitrogen deposition and the distance from a construction project. The effect distance (≤ 0.005 mol N/ha/year) is 2.3 km for five ground-level houses in rural area (Cardinaals et al.,2019).

4.3. The decision-making autonomy of municipalities in a decentralized state

The provinces and municipalities in the Netherlands are responsible for environmental tasks, as well as for monitoring, enforcement, and the execution of permit issuance. Provinces and municipalities can delegate these services to an environmental agency, but they remain ultimately responsible (Ministerie van Algemene Zaken, 2024a). In addition to the responsibility for issuing permits, municipalities have administrative discretion when drafting the environmental plan. In doing so, municipalities take into account relevant components and aspects of the physical environment and, if necessary, coordinate with other governing bodies. This administrative discretion returns control to the local level, allowing municipalities to set quality standards tailored to local situations rather than applying general national standards. Furthermore, this administrative discretion provides municipalities with governance tools to achieve the objectives of the Environmental Act. Additionally, municipalities can set stricter or more lenient standards than the baseline protection norms of an area, based on additional research. An example of administrative discretion in sustainability is the ability to set custom rules for energy performance (VNG, 2020). An impact analysis of administrative discretion also reveals that municipalities have more control over environmental matters, and a complex reality lies behind the decision-making mechanisms within municipalities (Ministerie van Algemene Zaken, 2024a). However, the province can always overrule municipalities with an instruction rule. The purpose of this is to achieve the province’s environmental values (or other objectives) for the physical environment (IPLO, n.d.).

The Dutch government is heavily reliant on the administrative discretion of municipalities to make decisions about spatial planning within the municipality and to strategically address this actively (Needham, 1989). Moreover, local governments rely on revenue from property taxes in the Netherlands. To increase these property tax revenues, municipalities implement strategic real estate development. In this context, fiscal strategies such as converting municipally-owned land into urban areas play a significant role, as this can generate substantial financial gains despite being a one-time income. This land exploitation fiscal strategy is particularly attractive in densely populated areas where there is high demand for new housing (Götze & Hartmann, 2021). This active form of policy-making poses risks, especially during economically unstable times. To mitigate this financial risk, municipalities may act as intermediaries rather than direct developers of land (Van Oosten et al., 2017). Urban development driven by the fiscal needs of individual municipalities can lead to competition rather than cooperation between municipalities. This can be seen as a prisoner's dilemma, where each municipality offers cheap land to attract developers and increase local tax revenues, and overlooking the national and regional interests (Colsaet, 2018).

A decentralized unitary state, where municipalities have administrative discretion, creates a dynamic environment and keeps governments alert, resulting in the most democratic and efficient execution of policy. In terms of infrastructure and spatial development, policy freedom scores a 7 out of 10, meaning that municipalities have considerable freedom to shape policies (Raad voor het Openbaar Bestuur, 2019). Decentralization means that the government becomes more reliant on local performance, primarily on the local willingness and capacity of municipalities to successfully execute tasks and responsibilities. However, this is not always a given, particularly concerning environmental interests (Burström & Korhonen, 2001). The political alignment within a municipality also influences the power dynamics between local urgencies, willingness, and the capacity of a municipality to achieve environmental goals (Zuidema & De Roo, 2014). Decentralization and the policy freedom of municipalities contribute to renewing governance to effectively address challenges within municipalities. However, central policies and regulations play an indispensable role in ensuring that decentralization functions properly. National frameworks guarantee minimum standards, encouraging local governments to develop solutions tailored to their specific regions(Zuidema & De Roo, 2014).

The Netherlands is reliant on the policy freedom of municipalities in the issuance of nature permits and the balance between urban development and nitrogen reduction. Due to the autonomy, municipalities have the flexibility to set their own quality standards and shape spatial developments within their jurisdiction, but they must also comply with national nitrogen regulations. This tension can lead to differences in permit issuance. Financial incentives, such as land exploitation and real estate development, encourage municipalities to facilitate new construction projects, while strict nitrogen regulations impose limitations. Additionally, political alignment within municipalities influences how environmental goals are prioritized and implemented. The Dutch decentralized system provides room for urban growth on the one hand, while on the other hand requiring municipalities to meet ecological objectives. Understanding the tension municipalities face, provides insights into the potential effectiveness of the Wnb and Wsn policies and the legal, economic, and spatial challenges surrounding nature permits.

4.4. Criteria for classifying the suspicion level of new built environment development projects

Nature permits apply the legally regulated evaluation to exclude negative effects on nitrogen-sensitive N2000 areas. However, it cannot be ruled out that some projects have still been incorrectly assessed. By assigning a suspicion level, permits can be objectively evaluated to indicate questionable motives.

The suspicion levels are based on the Wnb and provide additional insight into why certain nature permits are considered suspicious in balancing the built environment and nitrogen reduction. This is done by applying specific criteria, allowing for a distinction to be made within the steps of the Wnb. These criteria encompass differences in individual project calculations, which can result in deviations leading to incorrectly assessed nature permits by the decision-making body. For this reason, each approval step has one or more suspicion levels, as shown in Table 2. These criteria are essential in determining the extent to which a nature permit is considered suspicious, as they provide insight into structural patterns and deviations within the permitting procedure.

The suspicion levels in Table 2 are not ranked according to an increasing likelihood of negative effects on nitrogen-sensitive N2000 areas and have no internal hierarchy. They are assigned solely based on the criteria corresponding to the suspicion level.

Table 2: Overview of the steps of the Wet Natuurbescherming and their corresponding suspicion level, based on project criteria. Suspicion levels range from 1 to 8, without internal hierarchy.

Steps Wet Natuurberscherming	Criteria for Suspicion Level	Criteria Level	Suspicion Level
Step 1 AERIUS Calculation <0.005:	Documents that comply with the guidelines of Cardinaals	1.1	1
	Documents with a permit-free construction phase	1.2	2
	Documents with a distance <1km towards the Nitrogen Sensitive Natura 2000 area	1.3	3
	Documents with > 50% missing variables	1.4	
	Documents with significant variable outlier(s)	1.5	
Step 2 AERIUS Calculation ≥0.005:	Documents with internal offsetting	2.1	4
	Documents with no clearly applied approval step.	2.2	5
Step 3 AERIUS Calculation ≥0.005:	Documents with ecological screening	3	6
Step 4 AERIUS Calculation ≥0.005:	Documents with detailed ecological impact assessment and/or external offsetting	4	7
Step 5 AERIUS Calculation ≥0.005:	Documents with ADC assessment	5	8

- *Suspicion Level 1:* Projects with an AERIUS calculation of <0.005 mol N/ha/year, where the criteria in the document comply with the guidelines of Cardinaals (Appendix 1), are classified as suspicion level 1. These projects are considered the least suspicious due to their adherence to the guidelines, they are unlikely to face significant permit-related complications.
- *Suspicion Level 2:* Projects approved between 2021 and 2022, requiring only an AERIUS calculation for the operational phase, are classified as suspicion level 2. These projects raise suspicion due to the criteria of the temporarily established measure to disregard the construction phase calculation. This means that the exact negative impact on nitrogen-sensitive N2000 areas is unknown.
- *Suspicion Level 3:* Projects that meet the criteria level 1.3 OR 1.4 OR 1.5 are classified as suspicion level 3. These projects raise suspicion due to incompliance with the guidelines of Cardinaals, a lack of transparency in the calculation, or significant deviations in the variables used in the AERIUS calculation. This means that the impact on nitrogen-sensitive N2000 areas is questioned.
- *Suspicion Level 4:* Projects where internal offsetting has been applied for approval are classified as suspicion level 4. These projects raise suspicion due to the Council of State's decision that internal offsetting may no longer be used to grant a permit. This means that the negative impact on nitrogen-sensitive N2000 areas is no longer valid and can be reassessed.
- *Suspicion Level 5:* Projects where no clear approval step of the Wnb has been used are classified as suspicion level 5. These projects raise suspicion due to the use of an alternative reasoning to justify the approval. This means that the negative impact on nitrogen-sensitive N2000 areas has been legally justified, but it raises questions about the necessity of finding a reason for approval.
- *Suspicion Level 6:* Projects with an ecological screening are classified as suspicion level 6. These projects raise suspicion due to the total nitrogen deposition (≥0.005 mol N/ha/year). This means that, in the case of an incorrect assessment, the negative impact on nitrogen-sensitive N2000 areas cannot be excluded.
- *Suspicion Level 7:* Projects with a detailed ecological impact assessment are classified as suspicion level 7. These projects raise suspicion due to the total nitrogen deposition and their rejection in earlier steps of the Wnb. This means that, in the case of an incorrect assessment, the negative impact on nitrogen-sensitive N2000 areas cannot be excluded.
- *Suspicion Level 8:* Projects with an ADC Assessment are classified as suspicion level 8. These projects raise suspicion because no alternative is available, a compelling reason is required, and compensation is required. This means that a negative impact on nitrogen-sensitive N2000 areas occurs.

5. Methods

This research employs a mixed-methods approach, combining quantitative and qualitative techniques to provide both numerical evidence and contextual understanding of the motives used to grant nature permits for new built environmental development projects in North Holland. All statistical calculations are based on a self-constructed dataset, compiled from variables obtained from nature permits issued by municipalities/environmental services in North Holland.

5.1. Dataset

The dataset includes data from 390 new built environment development projects, granted between 2018 and 2024, excluding roadworks and electricity networks. Sourced from municipal records and the public database *ruimtelijkeplannen.nl/view* using the NL.IMRO codes and the corresponding municipal identification numbers. Selection criteria focused on projects within the province of North Holland, serving as the case study area. If no data was available for a variable, the corresponding cell was left empty. Based on the variables from the nitrogen documents, the criteria can be assigned to determine the corresponding suspicion level in sub-question 1. Within the dataset of 390 nitrogen calculation documents, a classification was made based on specific identification criteria (see Table 4). The final dataset was constructed based on variables collected from nitrogen calculation documents, and ArcGIS spatial analysis (see Table 3).

*Table 3: Overview of all collected and utilized variables, with * indicating variables analyzed in research question 1 and ** indicating variables analyzed in research question 3.*

Variable	Description
Municipality **	Name of the municipality where the project is located.
Total units of built environmental development *	Total number of units developed in the project.
Of which: apartments *	Number of units that are apartments.
Of which: ground-level *	Number of units that are ground-level houses.
Project area (GFA, m²) *	Total gross floor area (GFA) of the project in square meters.
Distance to nitrogen-sensitive Natura 2000 areas (km) *	Distance between the project and the nearest nitrogen-sensitive Natura 2000 area in km.
Total NOx emissions during construction phase *	Total NOx emissions produced during the construction phase.
Total NOx emissions during operational phase *	Total NOx emissions produced during the operational phase.
Total nitrogen deposition results (mol/ha/year)	Combined nitrogen deposition from both construction and operational phases in mol/ha/year.
Traffic movements during construction phase (all transport types) *	Total number of transport movements during construction phase.
Traffic movements during operational phase per year (all transport types) *	Total number of transport movements per year during operational phase.
Presence of machinery	Whether machinery is used in the project (Yes/No).
Quantity of machinery used *	Number of machines used during the project.
Aerius calculation year *	Year in which the nitrogen deposition was calculated using Aerius.
Construction period (years) *	Total duration of the construction phase in years.
Address and postal code	Project location details.
Environmental service region (Omgevingsdienst) **	The environmental service region responsible for assessment.
Property value (2018) **	Estimated property value in 2018 in thousands of euros.
Population size per municipality **	Total population in the municipality.
Criteria Level **	Criteria aspects in the nitrogen document.
Suspicion Level **	The suspicion level classified based on the criteria level
Size of the company **	Size of the company responsible for the project (e.g., small, medium, large).
Category of the company **	Sector or category the company belongs to (e.g., construction, real estate).

Figure 4 displays the first 10 new built environmental development projects along with their corresponding data. This figure provides an insight into how the data is processed per variable in Excel.

Municipality	Total Units of	Of which are a	Of which are g	Project area ((	Distance to ni	Total NO emis	Total NO emis	Total Depositi	Traffic mover	Traffic mover	Presence of m	Quantity of m	Aerius calcula	Construction	adres	postcode	criteria level	Suspicion lev	Size company	Category com	Omgevingsdi	property value	Population si
Aalsmeer	1	0	1		9	252,6	218	0	4916	69746	yes	11	2024-2025	0,6	Andorraweg(	1432 DB Aals	1.1	1	Medium-size	Construction	OD NZKG	290-325	0 - 35056
Aalsmeer	1	0	1		8,4	284		0	4190		yes	8	2023	1	Hooftdweg 19	1433 JX Kude	1.1	1	Micro	Others	OD NZKG	290-325	0 - 35056
Aalsmeer	1	0	1	712	8,28	61,6	1,4	0	1000	6278	yes	9	2023	0,6	Oosteinderw	1432 BH Aals	1.1	1	Small	Consultancy	OD NZKG	290-325	0 - 35056
Aalsmeer	853			350000	7	985,4	529,9	0,01	24023,3	1460000	yes	9	2022-2023	3	Aalsmeerder	1432 EE Aals	2.1	4	Small	Consultancy	OD NZKG	290-325	0 - 35056
Aalsmeer	3	0	3		7,5	16	2,5	0	1878	9.417	no		2024-2025	1	Hornweg 293	1432 GL Aals	1.1	1	Large	Engineering	OD NZKG	290-325	0 - 35056
Aalsmeer					9	707,3	9217,4	0,11	58474		yes	28	2023-2024-2	2	Machineweg	1432 ET Aals	2.1	4	Medium-size	Consultancy	OD NZKG	290-325	0 - 35056
Aalsmeer	156	136	20		10			0	6552	712480	yes	10	2023	2	Zwarteweg 7!	1431 VJ Aals	1.1	1	Large	Government	OD NZKG	290-325	0 - 35056
Aalsmeer	22	0	22		9,5			0	1848	125560	yes	10	2023-2024	1	Ophelialaan :	1431 HS Aals	1.1	1	Large	Government	OD NZKG	290-325	0 - 35056
Aalsmeer	1	0	1		11,6	18,1	2,4	0	1250	6292,6	yes	5	2024		Uiterweg358	1431 AX Aals	1.1	1	Micro	Others	OD NZKG	290-325	0 - 35056

Figure 4: Overview of the first 10 new built environmental development projects with their corresponding data.

Out of the total, 40 documents included a reasoning that the construction phase was permit-free. Additionally, 77 project locations in the documents were located within a radius of 1 km from a nitrogen-sensitive N2000 area. Furthermore, 13 documents were identified with more than 50% missing values, preventing a complete nitrogen calculation for both the construction and operational phases. A total of 21 documents are identified as statistical outlier based on the values in their nitrogen calculations. The number of documents with a total deposition of ≥0.005 mol N/ha/year amounts to 71 documents. The remaining 229 documents comply with the guidelines of Cardinaals.

Table 4: Amount of new built environment development projects based on suspicion criteria, with the corresponding number of documents per criteria.

Criteria	Criteria Level	Amount
Permit-free	1.2	40
Within 1 kilometer	1.3	77
>50% missing values	1.4	13
z-score outlier (>3 or <−3)	1.5	21
Total deposition of ≥0.005 mol N/ha/year	2.1-5	71
Comply with the guidelines of Cardinaals	1.1	229

First, all documents that included reasoning that the construction phase was permit-free were identified. Secondly, the documents with the criteria indicating a nitrogen deposition of ≥0.005 mol N/ha/year were identified. All 317 projects with a nitrogen deposition of <0.005 mol N/ha/year (including permit-free) were analyzed in SPSS to establish the remaining criteria. Outliers (extreme deviations in the data) were identified using a z-score, which measures how far a value deviates from the average (with the range of <−3 and >3). Identifying these extreme values helps to understand why certain projects stand out and still receive a permit. Although their calculated nitrogen deposition falls below the threshold of <0.005 mol N/ha/year. The variables distance to N2000 areas and AERIUS calculation year were excluded because distances greater than 20 km are unlikely to impact nitrogen-sensitive areas, and extreme values for the calculation year do not provide meaningful insights. Table 5 presents the values of the 21 documents containing a significant outlier.

Table 5: Corresponding values of the 21 documents with a significant z-score outlier of the 317 analyzed documents. These documents exhibit extreme deviations, such as the NOx emissions during construction phase. Despite the extreme deviations, they fall under the AERIUS calculation threshold (<0.005 mol N/ha/year), raising questions how these calculations are performed.

Document ID	Total Units	Apartments	Ground-level	Project area (GFA)	NOx construction phase	NOx operational phase	Traffic movements construction phase	Traffic movements operational phase	Quantity of machinery	Construction period	AERIUS calculation years
8								17520000			
50					1296,9				63	7	7
51	1004	1004									
61	1700	1700		230000	3100,76					10	
72								57812715			
80			170								
91			256								
107			149								
124					1340,1						
143										8	
148					1416,5		161156		101		6
149							339502				
151	3800	3800				1700					
152					1465,4						6
176					2377,15					7	
180							411862				
181						8376,8					
211			329							8	
256					1263,2		140520				
291			266								
308							167900				

Additionally, SPSS was used to check for missing data. If more than 50% of the 12 analyzed variables (marked with * Table 3) were missing, the document was considered a significant issue (Salgado et al., 2016) and seen as suspicious. It was also assumed that some data were intentionally omitted to facilitate project approval. Therefore, the missing data were included in the z-score analysis. A total of 13 documents have a missing count of ≥6 (see Table 6).

Table 6: The 13 documents with a missing count of ≥6. These documents were missing more than 6 values required for a complete AERIUS calculation.

Document ID	Amount of Missing Values
13	6
22	6
69	6
82	6
166	6
181	8
235	7
242	6
247	6
255	7
295	6
296	7
303	7

Finally, a geospatial analysis was conducted in ArcGIS, using the address and postal code for each new built environmental development project. This geospatial analysis made it possible to add spatial data to the projects, such as the distance to N2000 areas, environmental agencies, population size, and property value. Figure 5 displays all 390 projects, with the 77 projects located within a 1 km radius highlighted in yellow.

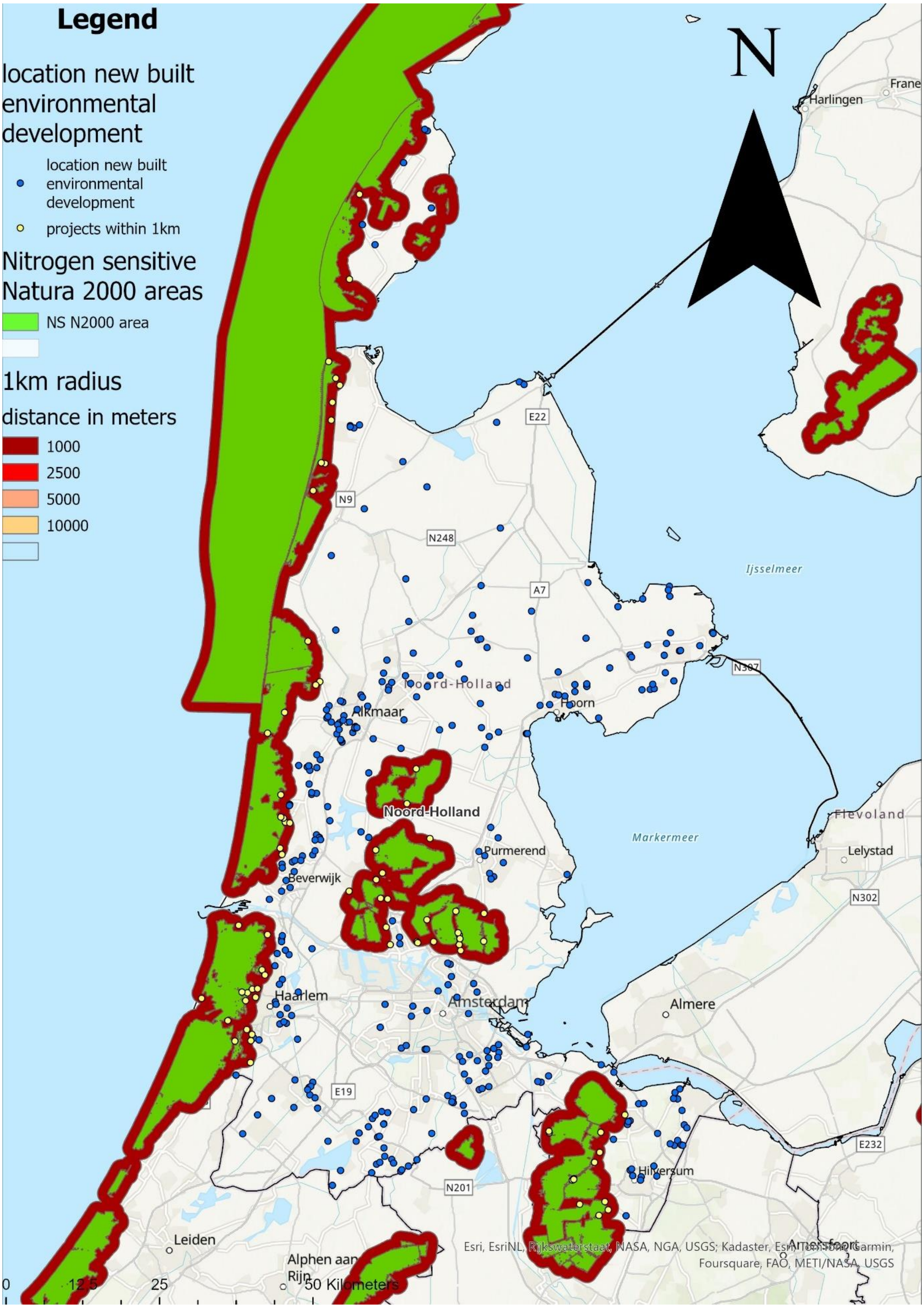

Figure 5: The 390 new built environmental development project locations in North Holland. The 77 projects within a radius of 1 km of a nitrogen-sensitive Natura 2000 area are highlighted in yellow.

5.2. Data Analysis

For projects with an AERIUS calculation of ≥0.005 mol N/ha/year, the conclusions from the nature permits were further examined to determine the corresponding criteria level. Criteria level 1.1 was assigned to suspicion level 1, and so on. However, criteria levels 1.2 and 1.3 could overlap with multiple suspicion levels. In cases where an overlap occurred, the highest suspicion level was assigned to avoid redundancy.

The influence on the suspicion level was analyzed by examining municipalities, environmental agencies, responsible companies, population size, and property value. This analysis was conducted using a Bayesian ANOVA to identify independent variables associated with higher suspicion levels in environmental permit approvals. To identify trends, boxplots were generated. Additionally, crosstabs and bar charts were used to illustrate the frequency of suspicion across variable categories. Ordinal regression was also applied to determine the likelihood of higher suspicion levels and their significant impact.

To ensure privacy, companies were categorized by size (micro, small, medium, or large) based on EU guidelines (European Commission, n.d.) and by category, using information from LinkedIn and company websites.

5.3. Document Analysis

To generate more clarity and a deeper understanding about the grounds on which the decision-making body granted permits for the respective nitrogen calculations, a document analysis was conducted on the decisive conclusions and accompanying reasoning of 20 documents. Since not all documents could be analyzed, 20 documents were selected based on suspicion level, overlap between criteria, and proximity to N2000 areas, with a maximum of three projects per criteria level selected for the document analysis.

Projects falling under suspicion levels 1 to 7 were emphasized, as suspicion level 8 was not present in all 390 documents. Projects identified with overlap between multiple criteria levels (e.g., levels 1.2 and 1.5) were prioritized, as documents with multiple criteria levels exhibit multiple aspects that raise suspicion. Prioritizing these documents ensures that cases with a higher degree of irregularity are selected, potentially providing deeper insights into patterns of concern. For each overlap combination, up to two projects were selected, ensuring comprehensive representation whenever possible. With a priority for projects with a short distance to N2000 areas, using the variable *distance to nitrogen-sensitive Natura 2000 areas* or the location in ArcGIS.

This analysis focused on investigating the reasons why the project was approved within its respective approval step and suspicion level. To gain deeper insight into the decision-making process behind nitrogen calculations. With a subdivision of reasons to provide an overview of the choices made in the nitrogen calculation:

- Obscure the real impact
- No complete reduction after internal offsetting
- Temporary increase negligible
- No notification requirement necessary
- and Permit-free effect minimization
- Comply with the guidelines of Cardinaals

By classifying the reasoning, the analysis provides a structured overview of the choices made, highlighting where the decision-making authority allows flexibility in granting the nature permit.

6. Results

The results of the research on the approaches used to grant permits for new built environment development projects are presented in this chapter. The findings are structured according to the methodology, each addressing a key aspect of the suspicion level.

The first section outlines the findings related to the characteristics per suspicion level of the projects. The second section presents the results that influence the prevalence per suspicion level. The third section presents the results of the motives of the authorities responsible for approving nitrogen calculations within nature permits.

6.1. Data study

6.1.1. Characteristics per suspicion level

Table 7 shows the frequency of new built environment development projects and their corresponding suspicion level. A clear trend is visible: as the suspicion level increases, the frequency decreases. Only 8 projects required an ecological screening (level 6), and 7 projects required an detailed ecological impact assessment and/or external offsetting (level 7), together accounting for just 3.9% of the total. Moreover, no projects were approved at suspicion level 8. Another observation is the share of projects approved at suspicion level 4, with 46 projects now deemed illegal by the Council of State, of which 33 are located within a 1 km radius.

Table 7: The frequency of documents per suspicion level.

Suspicion level	Frequency	Percentage (%)
1	229	58.7
2	20	5.1
3	70	18.0
4	46	11.8
5	10	2.6
6	8	2.1
7	7	1.8
8	0	0.0
Total	390	100

The majority of the total 43,995 new built environmental development units are concentrated in suspicion levels 1 (28.73%), 3 (19.85%), and 4 (31.81%) (Figure 1 Appendix 3). Additionally, of the 7 projects in suspicion level 7 6,805 building units (15.47%) were assessed, with 6,200 building units stemming from a single project. A significant portion of the NOx emissions during the construction phase (40.21%) originates from projects classified under suspicion level 1, followed by level 4 (30.93%), and 0% originating from suspicion level 2 due to the temporarily established measure to disregard the construction phase calculation (figure 6). The NOx emissions during the operational phase are predominantly caused by suspicion level 4 (54.1%), as shown in Figure 7.

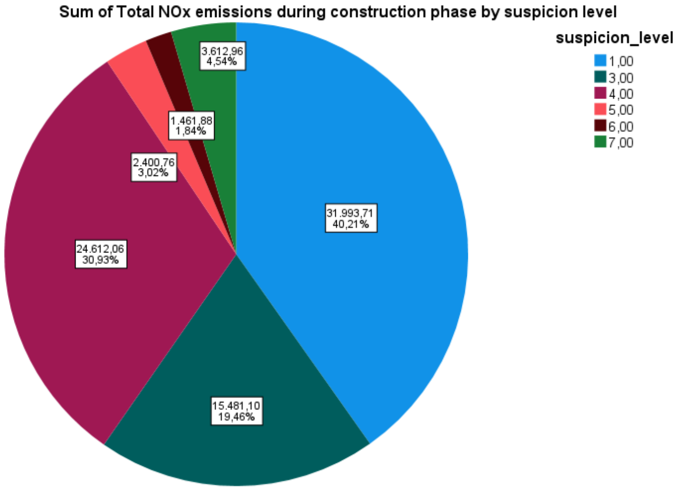

Figure 6: The sum of NOx emissions during the construction phase by suspicion level. Suspicion level 2 is missing due to the temporary legislation of the permit-free construction phase.

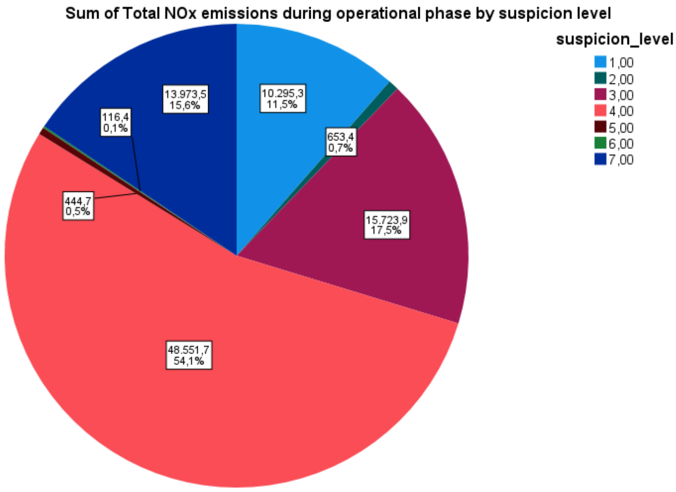

Figure 7: The sum of NOx emissions during the operational phase, categorized by suspicion level, shows that suspicion level 4 accounts for 54.1% of the total.

The bar chart (Figure 8) illustrates a clear increase in both construction and operational NOx emissions at suspicion level 4, with a sharp peak in operational emissions at suspicion level 7. It is important to note that both suspicion levels 4 and 7 exhibit high standard deviations across all three categories (Table 1 Appendix 3), due to a considerable variation of large- and small-scale projects with varying emission profiles.

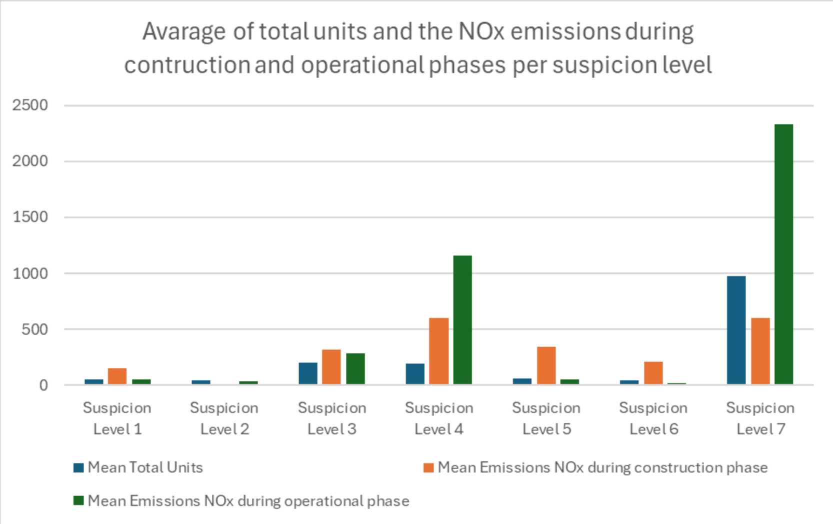

Figure 8: The mean of total building units, NOx emissions during the construction phase, and NOx emissions during the operational phase per suspicion level. The bar chart highlights variations across different suspicion levels, with peaks at suspicion level 4 and 7.

Table 8 shows that distance does influence the suspicion level. At a distance of 0.00 km, the average suspicion level is 2.606 and decreases by 0.111 per kilometer, which aligns with expectations. However, there are exceptions, as shown in Figure 9. This figure illustrates that, for example, two projects with suspicion level 7 are located more than 10 km away from a nitrogen-sensitive N2000 area (in Heerhugowaard and Opmeer). But it also shows that projects located near N2000 areas sometimes have a low suspicion level and that there are differences between municipalities and their approach to suspicion levels. Additionally, the figure highlights variations in suspicion levels across different environmental agencies, with a high concentration of suspicious projects in IJmond.

Table 8: Regression analysis shows that the distance to nitrogen-sensitive Natura 2000 areas lowers the suspicion level, with a decrease of 0.111 per kilometer. The constant of 2.606 represents the average suspicion level at a distance of 0.00 km.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,606	,111		23,558	,000
	Distance to nitrogen-sensitive Natura 2000 area (km)	-,111	,016	-,377	-7,156	,000

a. Dependent Variable: suspicion_level

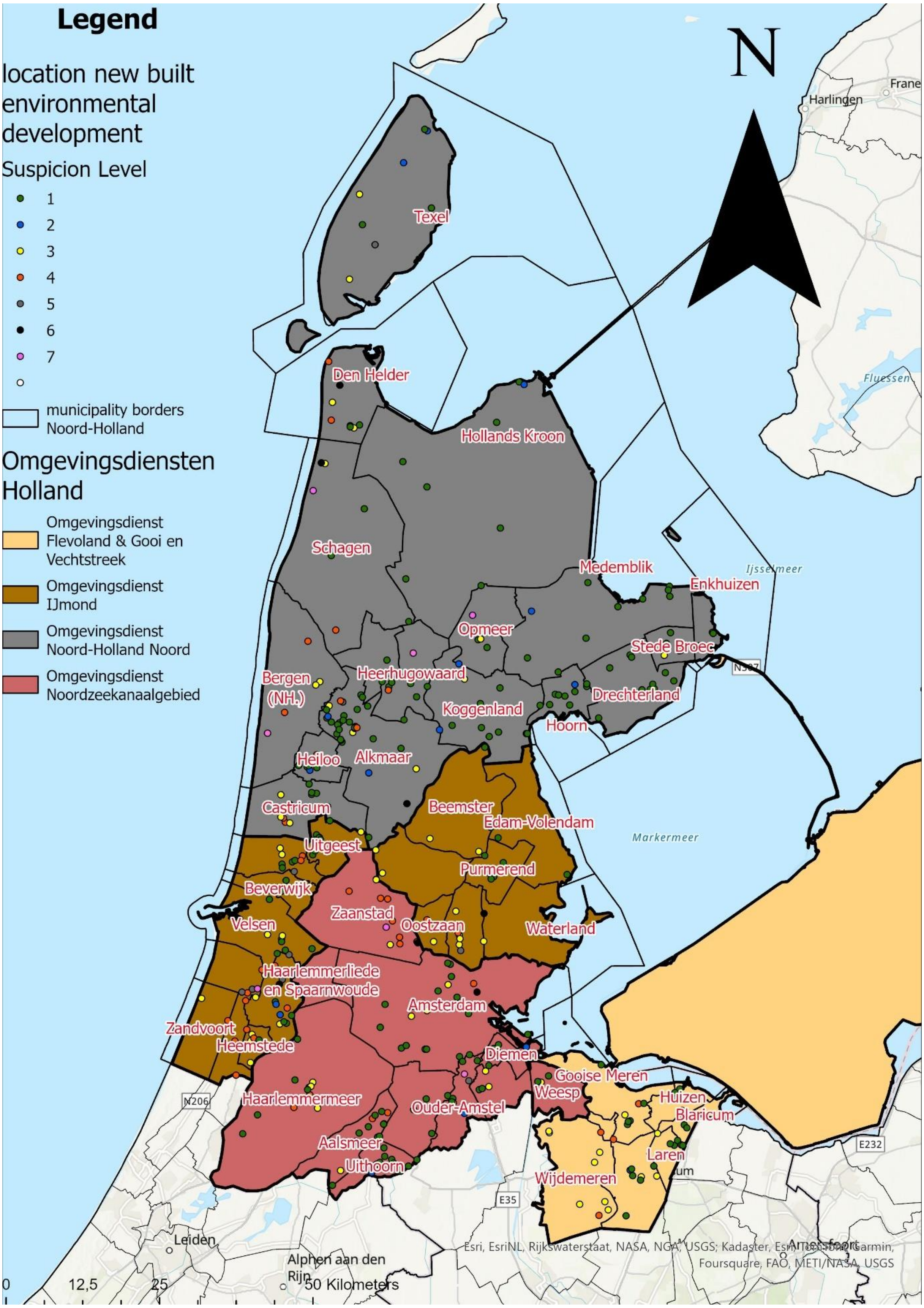

Figure 9: Locations of new built environmental development projects categorized by suspicion level within the municipalities and Environmental Agencies (Omgevingsdiensten) of North Holland.

6.1.2. The influence of spatial factors and decision-making bodies

The boxplot in Figure 10 highlights the municipalities with a high median suspicion level, including Bergen, Bloemendaal, Heemstede, Landsmeer, Oostzaan, Wijdemeren, Wormerland, Zaanstad, and Zandvoort. In these municipalities, a nature permit is more often granted based on a higher suspicion level.

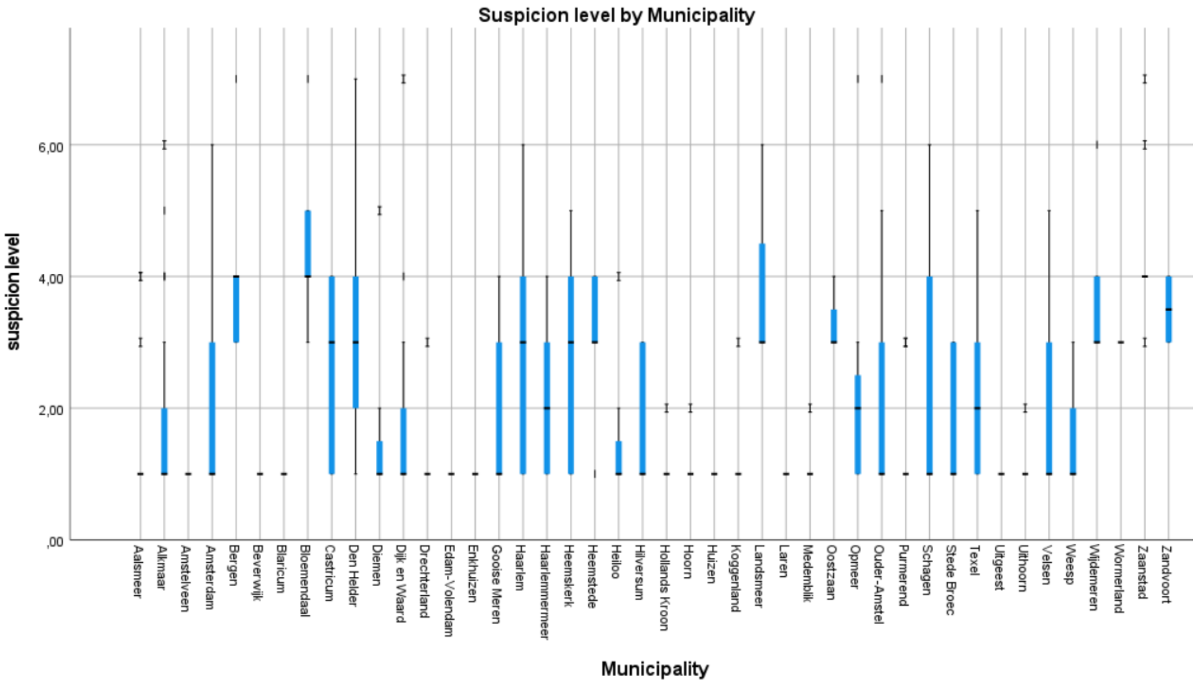

Figure 10: The visualization of the distribution of suspicion levels across the municipalities, with the blue bars representing the interquartile range and black whiskers indicating the full data spread, including potential outliers.

However, the regression analysis does not show that any specific municipality is associated with a significantly higher suspicion level. Nevertheless, some municipalities show a significant tendency to approve projects at lower suspicion levels, as shown in Table 9. This means that in these municipalities, approvals are more frequently issued at lower suspicion levels compared to other municipalities.

Table 9: The regression analysis of municipalities with a negative effect on the suspicion level. With the corresponding estimated coefficients and significance level for each municipality.

Municipality	Estimate	Sig.
Aalsmeer	-2.968	0.016
Amsterdam	-2.661	0.048
Drechterland	-4.207	0.011
Hollands Kroon	-3.863	0.022
Hoorn	-3.863	0.022
Koggenland	-4.111	0.013
Medemblik	-4.093	0.015
Purmerend	-3.191	0.033
Uithoorn	-4.093	0.015
Weesp	-2.515	0.026

Table 10 shows the distribution of each suspicion level per environmental agency. The ANOVA test reveals that IJmond has the highest average suspicion level of 2.575, while Noord-Holland Noord (NHN) has the lowest average suspicion level of 1.876. The boxplots (Figure 11) also show that IJmond exhibits the greatest variation in assessments among the four Environmental Agencies, showing a more diverse approach to approvals. However, the differences between the environmental agencies are not significant, with no specific environmental agency having a strong influence on the suspicion level (Table 2 Appendix 3).

Table 10: the distribution of each suspicion level per environmental agency in North Holland. With the highest number of permits granted in environmental agency (OD) Noord-Holland Noord (NHN).

	Environmental Agency			
Suspicion level	OD Ijmond	OD NHN	OD NZKG	OFGV
1	36	106	64	23
2	2	12	5	1
3	25	20	13	12
4	15	14	12	5
5	6	2	2	0
6	2	3	2	1
7	1	4	2	0
Total	87	161	100	42

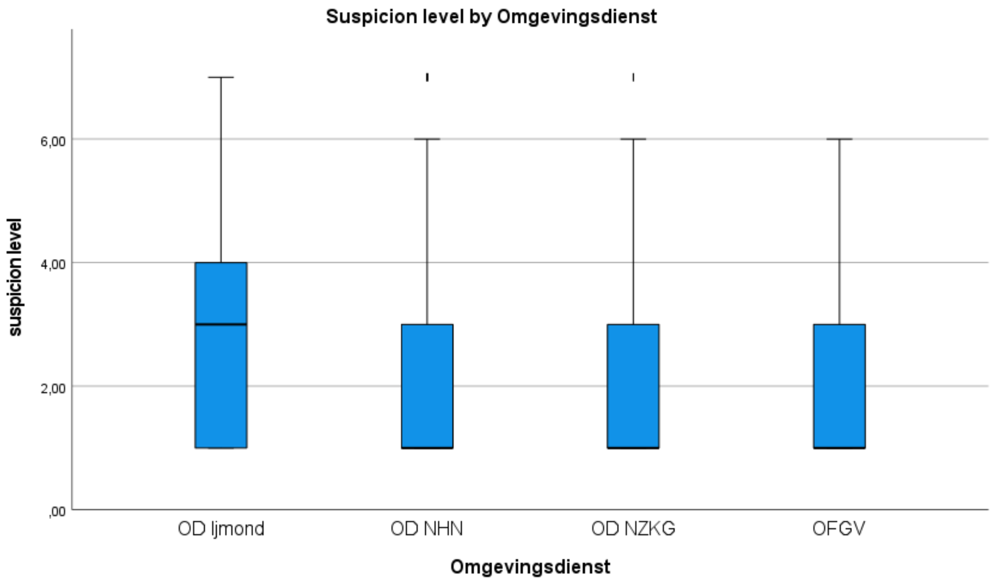

Figure 11: The visualization of the distribution of suspicion levels across the environmental agencies, with the blue bars representing the interquartile range and black whiskers indicating the full data spread, including potential outliers.

Tables 11, 12, and 13 show the significance of each variable towards the suspicion level. It shows that medium-sized companies do have a significantly lower suspicion level than those investigated by larger or smaller companies. The property value differs in significance. The lowest (≤160) and highest (≥325) property values both have a significant higher suspicion level. In contrast, property values between 160 and 190 show a significant lower suspicion level, with an estimate of -19. The category of the companies is not significantly associated with suspicion levels (Table 3 Appendix 3).

Table 11: The relationship between company size and the suspicion level. With the estimated effect, the significance level, and the interpretation. With small companies as the reference category.

Company Size	Estimate	Sig. (p-value)	Meaning
Large	0.313	0.261	No significant effect
Medium-Sized	−0.529	0.046	Small but significant negative effect
Micro	−0.013	0.962	No significant effect
Small	0.0	-	Reference category (comparison point)

Table 12: The relationship between population size (per municipality) and the suspicion level. With the estimated effect, the significance level, and the interpretation. With the population size 68980-130668 as the reference category.

Population Size	Estimate	Sig. (p-value)	Meaning
0-35056	0.904	0.002	Significant effect, increased suspicion level
35057-68979	0.658	0.047	Small but significant effect
130669-361699	1.854	0.000	Large effect, strongly increased suspicion level
361700-918117	0.165	0.732	No significant effect
68980-130668	0.0	-	Reference category (comparison point)

Table 13: The relationship between property value (per municipality) and the suspicion level. With the estimated effect, the significance level, and the interpretation. With the unknown property value as the reference category.

Property Value (x 1000 €)	Estimate	Sig. (p-value)	Meaning
160 or less	1.920	0.003	Significant effect, increased suspicion level
160-190	−19.295	0.000	Large negative effect, strongly decreased suspicion level
190-215	0.351	0.454	No significant effect
215-240	0.183	0.687	No significant effect
240-260	−0.294	0.571	No significant effect
260-290	0.593	0.155	No significant effect
290-325	−0.354	0.565	No significant effect
325 or more	1.099	0.007	Significant effect, increased suspicion level
Unknown	0.0	-	Reference category (comparison point)

6.2. Document study

6.2.1. Reasons for granting nature permits

The basis for the approval of the 20 documents is presented in Table 14, with a summary for each document provided in Appendix 2.

Table 14: An overview of the environmental permit conclusions for the approval of 20 nitrogen calculation documents, including the provided justification for their approval. Including the suspicion level, criteria overlap and proximity to Natura 2000 areas.

	20	21	75	84	94	116	165	173	207	210	218	228	264	286	299	309	353	358	363	383
Suspicion Level	2	6	6	7	5	3	4	2	1	3	1	3	5	3	3	4	3	3	4	7
Criteria Overlap	-	1.3	-	1.3	1.3	1.2 1.5	-	-	-	1.2 1.3 1.4	-	1.2 1.4 1.5	1.3	1.2 1.3 1.5	1.2 1.4	-	1.2 1.4	1.2 1.3	1.2 1.3	1.3
Proximity to N2000 (km)	1.5	0	3.75	0.05	0.075	2.4	1.25	2.6	1.4	0.012	1.6	4	0.1	0	4	2.9	3.8	0	0.019	0.8
obscure the real impact		x										x	x							x
No complete reduction after internal offsetting				x			x					x				x				
Temporary increase negligible			x	x																x
No notification requirement necessary.					x															
Permit-free effect minimization	x					x		x		x		x		x	x		x	x	x	
Comply with guidelines of Cardinaals									x		x									

The analysis reveals that a recurring issue across multiple documents is the systematic exclusion of the nitrogen impact from the construction phase. This can be linked to suspicion level 2, where the construction phase is designated as permit-free, while nitrogen calculations for the operational phase are based solely on emissions from traffic movements. However, even with emissions of 8,376.8 kg/year in Document 228, it is concluded that there is no increase greater than 0.00 mol N/ha/year during the operational phase.

Furthermore, detailed ecological impact assessments often rely on generalized justifications to minimize or exclude significant nitrogen deposition effects. It is frequently concluded that a temporary increase in nitrogen deposition during the construction phase does not result in long-term consequences due to the short duration of activities and the relatively small contribution. A comprehensive description of this approach is provided in Document 75: *"Due to the relatively short duration of the construction activities and developments within the Natura 2000 area (where nitrogen deposition is actually decreasing), and because the nitrogen increase from the construction activities is relatively small, the construction of the 17 houses is not expected to have significant negative consequences, either in the short or long term."*

In some cases, it is also stated that the increase is limited to small portions of habitat areas, without considering cumulative effects. As concluded in Document 84: *"The nitrogen deposition increase occurs in only a small portion of the habitat type. Increases >0.10 mol/ha/year occur only in the 11 nearest hexagons, and increases >0.05 mol/ha/year occur only within a 500m radius around the project area."*

Additionally, several documents show a lack of transparency in nitrogen calculations, particularly when internal offsetting is applied. For example, in Document 309, while there is a decrease of 0.09 mol/ha/year, the actual construction phase deposition remains at 0.03 mol N/ha/year. Additionally, in the operational phase, while there is a decrease of 0.05 mol N/ha/year, 0.07 mol N/ha/year is still retained.

The analysis also shows that cumulative nitrogen deposition over longer periods is often underestimated, as the focus is placed on the maximum annual deposition rather than the total deposition of the project and its associated environmental effects. This approach can result in an incomplete understanding of a project's impact on nearby Natura 2000 areas. This methodology is clearly demonstrated in Document 383, where the total nitrogen deposition over the entire period (2023–2032) is actually 0.22 mol N/ha/year, yet only the maximum deposition of 0.03 mol N/ha/year is considered in the report, and the conclusion.

7. Discussion

This study provides insights into how municipalities strategically balance nitrogen regulations with built environment development. A striking finding is that no municipality has an influence on projects frequently having a high suspicion level. However, multiple municipalities do have an influence on projects often having a low suspicion level. With a total of 229 projects, out of the 390, at suspicion level 1 and only 3.9% at suspicion levels 6 and 7, the results indicate that municipalities systematically approve projects without increased scrutiny of their potential negative effects on nitrogen-sensitive N2000 areas. This can be seen as something positive. Since many projects already exclude negative effects through an AERIUS calculation. However, when looking at the number of projects where suspicion levels 2, 4, and 5 have been assigned, it raises the question of whether it would be better for all projects to be assessed for their potential negative effects, as is done in the detailed ecological impact assessment.

Among other reasons, because more than 54% of NOx emissions during the operational phase originate from suspicion level 4, internal offsetting. This approach demonstrates that approval can still be obtained despite the high emission output of 46 projects. Document analysis suggests that these emissions are not considered critical, despite N2000 areas' critical threshold and habitat types with a high WAV sensitivity score being generalized as having only short-term impacts. Some projects do not show a full reduction in nitrogen deposition, and in some cases, even entirely omit its impact in nitrogen assessment conclusions. The ruling by the Council of State has indeed indicated that this approach does not contribute to balancing the built environment and nitrogen reduction.

Spatial factors play a key role in project evaluation, but their influence differs in context. Distance to nitrogen-sensitive N2000 areas is such a crucial determinant. Suspicion levels decrease as the distance to nitrogen-sensitive N2000 areas increases, by 0.111 per kilometer. This reduction is however inconsistent, meaning that project location cannot be entirely detached from the expected suspicion level. Since there are projects where the distance to a nitrogen-sensitive N2000 area is more than 10 kilometers that receive a permit through a detailed ecological impact assessment. Additionally, 37 projects within a 1-kilometer distance from a nitrogen-sensitive N2000 area received a nature permit with an AERIUS calculation of <0.005 mol N/ha/year.

The economic factors and municipal location also have a significant role in the suspicion levels. Regression analyses show strong correlations between suspicion levels and property value, population density, and company size. These findings suggest that economic pressure and local development priorities influence how municipalities handle nitrogen assessments and permit applications. This indicates that municipalities with high property values and high population density tend to have higher suspicion levels, possibly due to shorter distances to N2000 areas and stricter enforcement of environmental management and spatial planning regulations. In contrast, areas with lower property values tend to focus more on economic growth and have a greater incentive to approve projects with minimal regulatory oversight. This can be linked to the prisoner's dilemma, where municipalities offer cheap land to attract developers and increase local tax revenues, while overlooking national and regional interests (Colsaet, 2018).

At present, the focus of nature permits is on the maximum annual nitrogen deposition and emissions, which leads to the long-term effects on nitrogen-sensitive N2000 areas of construction projects being overlooked, as only a single year is considered instead of all construction years. By pushing the boundaries of the Wnb, permits can be granted while concluding that no negative effects occur on nitrogen-sensitive N2000 areas, allowing construction to proceed. Adjustments in AERIUS-calculation methodologies could improve the accuracy of nitrogen assessments and better integrate long-term construction-phase effects into evaluations.

The Province of North Holland has implemented several policy initiatives, such as the 'Schoon en Emissieloos Bouwen' roadmap, the 'Handreiking Stikstofvrije Woningbouw' and the 'Provinciaal Programma Landelijk Gebied'. These initiatives promote innovation in materials and emissions management for new built environment development projects. Integrating these innovations into AERIUS calculations and project assessments could enhance nitrogen evaluations. However, on-site verification of AERIUS input data is essential to ensure full transparency in nitrogen calculations. Given the influence of companies on suspicion levels, companies play a key role in realizing these calculations with the corresponding materials and machines in practice.

Although national regulations provide a framework, the results highlight significant differences in municipal-level implementation. Despite spatial variations between municipalities, individual approaches are applied to assess projects within formal regulations. Due to constant changes in nitrogen policy approaches, a clear lack of transparency is evident. This is reflected in the systematic omission of construction-phase emissions and widespread use of internal offsetting, which has been frequently applied to facilitate construction while minimizing perceived negative effects on nitrogen-sensitive N2000 areas. A standardized methodology based on impact distance, such as Cardinaals' calculations, could increase consistency across municipalities, reducing the influence of spatial factors and policy autonomy on project assessments.

Centralizing regulations could reduce governmental dependence on municipalities, by eliminating the tensions they currently face. This can be achieved by addressing the political debate on reducing agricultural emissions, as agriculture is currently the largest contributor to nitrogen deposition, further limiting the nitrogen space for new built environment development. Reducing the dependence may also affect the willingness, urgency, and capacity of decision-making authorities to meet national housing targets (Zuidema & De Roo, 2014), such as the goal of building 300,000 houses before 2030. The current autonomy of municipalities allows them to find a balance between built development and nitrogen reduction despite suspicion, but it requires stricter oversight. In order to better map the impacts of new built environment development.

When considering the overall impact of built environment development on total nitrogen deposition in the Netherlands, along with the municipal approach to avoid fully assessing negative effects in evaluations, a broader reconsideration of regulations may be necessary. Since it has been demonstrated that municipalities continue to find ways to grant permits despite the strict 0.005 mol N/ha/year threshold, an alternative approach should be explored. This study does not address these alternatives but could contribute to finding a possibility where the built development and the reduction of nitrogen deposition do have an equilibrium.

While this study provides valuable insights, it has more limitations. The dataset focuses only on projects with a nature permit in North Holland, and the analysis is primarily quantitative, with some qualitative aspects in nitrogen assessment conclusions. A caveat should also be noted regarding the labeling of suspicion levels, as it is entirely possible that, in certain cases, permits were granted with full due diligence and were therefore legitimately issued. Therefore, findings may not be fully generalizable to other provinces and their spatial dynamics. Further research could provide deeper insights by analyzing rejected permit applications to understand the conditions under which projects are denied. But also by examining political influences on permitting decisions to determine whether housing targets impact approval processes, with the use of interviews. Which can provide insights into the reliability of AERIUS data and its verification in practice.

8. Conclusion

In summary, the results show that suspicion level 1 is the most commonly used approach. The share in the total number of building units and emissions during the construction and operational phases varies per suspicion level but shows that suspicion levels 4 and 7 contribute the most. It has also been demonstrated that suspicion levels decrease as the distance to nitrogen-sensitive N2000 areas increases. However, this is applied inconsistently, with many exceptions, indicating that no clear approach has been implemented under the Wnb across the entire province of Noord-Holland regarding suspicion levels.

Approval mainly occurs at an early stage under the Wnb, including permit-free construction phases and the use of internal offsetting, supplemented by projects with incomplete nitrogen calculations, assumptions that obscure the real nitrogen impact, or cases where no full reduction in nitrogen deposition occurs, yet these projects are granted a nature permits by municipalities or environmental agencies. This demonstrates that, even when negative effects occur in nitrogen-sensitive N2000 areas, they are not considered significant within the regulatory framework, permitting construction to continue. This is often facilitated by using the framing of emissions as "temporary" to justify approval, without considering the long-term or cumulative effects of nitrogen deposition.

Additionally, some municipalities are associated with a low suspicion level, indicating that they systematically choose suspicion levels where no strict assessment is required to rule out negative effects on nitrogen-sensitive N2000 areas. This makes the construction process easier and allows projects to proceed with fewer regulatory obstacles. In contrast, environmental agencies do not have a strong influence on suspicion levels. Moreover, sparsely populated areas with high property values more often have a high suspicion level, supporting the idea that municipalities strategically interpret nitrogen regulations rather than making decisions solely based on the ecological impact of the project.

In answering the main research question: *“How do decision-making bodies approach the granting of permits for new built environment development projects, given the suspicion about the balance between built development and nitrogen reduction?”* The study concludes that decision-making bodies employ strategic interpretations of nitrogen regulations to facilitate built development. While national regulations provide a legal framework, the decentralized decision-making structure results in varied approaches among municipalities. By identifying the applied suspicion levels and the reasoning in nitrogen assessments by municipalities, this study serves as a basis for policymakers to refine permit evaluation processes and strengthen nitrogen mitigation strategies.

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10. Appendix

10.1. Appendix 1

For the construction phase, the guidelines are based on the machinery used, as shown in Table 1. All machines are from the year 2015 or more recent, and the guidelines take into account the average operating hours these machines typically run during the construction of ground-level homes or apartments (Cardinaals et al., 2019).

Table 1: The materials used for the guidelines for the construction of 5 ground-based homes and 5 apartments (expressed in the number of operating hours per material). The year of manufacture of all equipment is based on 2015 or more recent (type 4) (Cardinaals et al., 2019).

Materieel	AERIUS	Grondgebonden woningen	Appartemen-ten
Graafwerkzaamheden bouwput	Graafmachine (200kw)	80	80
Verrijker 10 ton	Reach stacker (250kw)	100	200
Heien (heistelling)	Hijskraan (100kw)	40	40
Fundering (truckmixer)	Dumper (320kw)	40	40
Hijskraan tbv transporten op de bouw	Hijskraan (450kw)	300	elektrisch
Zwaar transport (# vb)*	**Zwaar vrachtverkeer**	**68**	**256**
Middelzwaar vrachtverkeer		285	450

** Totaal aantal transportbewegingen.*

Based on the values and the number of transport movements made during the construction phase, the impact distances have been calculated per number of ground-level homes and apartments, or a mix of these two housing types. There is a difference between urban and rural areas, with the impact distance generally being higher in rural areas. Tables 2 and 3 show the distances at which construction can take place without a permit, without any potential negative effects on the N2000 areas due to nitrogen deposition (Cardinaals et al., 2019).

Table 2: The effect distance for the construction phase of 0 to 500 homes in rural areas, expressed in kilometers. This includes ground-based homes and apartments, as well as a combination of these two housing types. As the number of homes increases, the effect distance increases. Calculations based on Table 2(Cardinaals et al., 2019).

Grondgebonden woningen → Appartementen↓	0	1	5 62 kg N	10	25	50	100	250	500
0	-	0,9	**2,3**	3,4	5,7	8,7	>10	>10	>10
1	-	1,1	**2,4**	3,5	4,9	8,7	>10	>10	-
5 65 kg N	**1,5**	**1,9**	**3,0**	**3,8**	**6,2**	**9,0**	**>10**	**>10**	-
10	2,4	2,6	**3,5**	4,6	6,4	9,4	>10	>10	-
25	4,0	4,4	**4,8**	4,9	6,5	>10	>10	>10	-
50	5,6	5,7	**6,2**	6,9	8,6	>10	>10	>10	-
100	8,4	8,5	**8,9**	9,5	>10	>10	>10	>10	-
250	>10	>10	**>10**	>10	>10	>10	>10	>10	-
500	>10	-	**-**	-	-	-	-	-	-

Table 3: The effect distance for the construction phase of 0 to 500 homes in urban areas, expressed in kilometers. This includes ground-based homes and apartments, as well as a combination of these two housing types. As the number of homes increases, the effect distance increases. Calculations based on Table 2(Cardinaals et al., 2019).

Grondgebonden woningen→ Appartementen↓	0	1	5 62 kg N	10	25	50	100	250	500
0	-	0,6	**1,3**	2,0	4,0	7,9	>10	>10	>10
1	-	0,7	**1,3**	2,1	4,1	7,9	>10	>10	-
5 65 kg N	**0,9**	**1,1**	**1,7**	**2,4**	**4,1**	**7,9**	**>10**	**>10**	-
10	1,4	1,5	**2,1**	2,8	4,5	7,9	>10	>10	-
25	2,7	2,8	**3,3**	3,9	4,7	7,9	>10	>10	-
50	4,1	4,4	**4,6**	4,6	7,8	9,0	>10	>10	-
100	6,8	7,8	**7,9**	7,9	8,8	>10	>10	>10	-
250	>10	>10	**>10**	>10	>10	>10	>10	>10	-
500	>10	-	**-**	-	-	-	-	-	-

The impact distances show that the greater the number of homes, the longer the distance must be from a N2000 area. The map in Figure 1 illustrates the distances to nitrogen-sensitive N2000 areas, and the accompanying table indicates the required distance for built environment development projects of a certain size. Larger projects (more than 250 houses or more than 100 apartments) are only permitted in dark green areas. In North Holland, the dark green areas are only in the region northeast of Alkmaar and in the region south of Amsterdam.

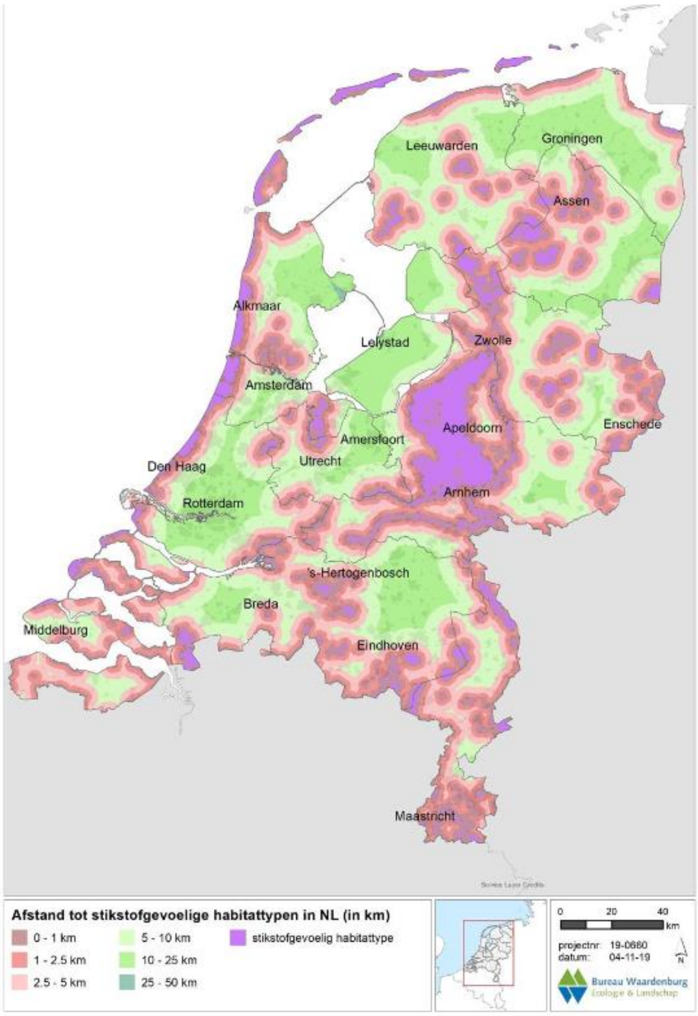

Figure 1: The distance to nitrogen-sensitive habitat types in the Netherlands, expressed in kilometers. It is evident that in North Holland, only the regions northeast of Alkmaar and south of Amsterdam qualify for homes with an effect distance of more than 10 km, based on Table 3 and 4 (Cardinaals et al., 2019).

The construction phase is considered a temporary (small) contribution, which differs from the ongoing, fixed annual contribution of nitrogen deposition that results from the operational phase. The operational phase can also affect the competitive position of habitat types and may result in an accumulation of organic material in N2000 areas. Similar to the construction phase, certain assumptions have been made for the impact distance during the operational phase. In the calculation of the impact distance for the operational phase, seven assumptions were considered, as shown in Table 4. Additionally, a distinction was made between the transport movements related to the number of homes (0 to 500) and the type of homes in rural and urban areas (Cardinaals et al., 2019).

Table 4: The 7 assumptions used in the calculations of the impact distance for the operational phase of a housing project. Overview of the associated emissions released during the permanent nitrogen deposition and the location where the operational phase takes place (Cardinaals et al., 2019).

Assumptions operational phase:
Gas-free construction (there are no emissions from heating and cooking).
Emissions from daily use by residents (BBQ, fireplace, etc.) are not included.
Emissions are calculated based on traffic generation according to CROW 381 figures.
Emissions are calculated based on traffic generation on local roads.

The calculation assumes a road length of at least 6 km.
Amsterdam was taken as the reference location for urban areas.
The area north of Ommen was taken as the reference for rural areas.

In addition to the seven assumptions used to calculate the impact distance, a distinction was also made for the transport movements associated with the number of homes (0 to 500) and by housing type (detached houses, terraced houses, and owner-occupied and rental apartments) in rural and urban areas. Based on the number of transport movements (including freight traffic), the impact distance of the number of homes and housing types in rural and urban areas was calculated, as shown in Table 5 and 6. From the two tables, it can be observed that in rural areas, the impact distances for large, small-scale housing projects are greater. Table 6 shows that from 100 homes onwards, for every type of housing, the impact distance exceeds 5 km in rural areas. For urban areas, an impact distance of more than 5 km applies only for 500 detached houses (Cardinaals et al., 2019).

Table 5: The impact distance of the operational phase of light traffic in rural areas, expressed in kilometers, is based on the number of transport movements per day, including freight traffic. Regarding the number of homes (0 to 500 homes) and housing type (detached, terraced, and owner-occupied and rental apartments), the impact distance increases as the number of homes increases for each housing type (Cardinaals et al., 2019).

aantal woningen	**1**	**5**	**10**	**25**	**50**	**100**	**250**	**500**
type woningen								
Vrijstaand	0,2	1,1	2,3	4,2	4,6	5,0	5,0	5,0
Rijtjeshuis		1,1	1,9	4,2	4,6	5,0	5,0	5,0
Appartement koop				4,2	4,6	5,0	5,0	5,0
Appartement huur	-	-	-	4,0	4,4	5,0	5,0	5,0

Table 6: The impact distance of the operational phase of light traffic in urban areas, expressed in kilometers, is based on the number of transport movements per day, including freight traffic. Regarding the number of homes (0 to 500 homes) and housing type (detached, terraced, and owner-occupied and rental apartments), the impact distance increases as the number of homes increases for each housing type (Cardinaals et al., 2019).

aantal woningen	**1**	**5**	**10**	**25**	**50**	**100**	**250**	**500**
type woningen								
Vrijstaand	0,2	0,9	1,8	3,3	4,1	4,6	4,8	5,0
Rijtjeshuis		0,7	1,6	3,3	4,1	4,6	4,8	4,9
Appartement koop				3,3	4,1	4,6	4,8	4,9
Appartement huur				2,8	4,0	4,6	4,7	4,9

To provide insight into the nitrogen deposition resulting from traffic movements, the progression of deposition from a road (at least 6 km long) with 1,000 traffic movements per day is shown in figure 4. Figure 4 shows that only from a distance of 4.9 km onwards does the deposition reach 0.00 mol at a traffic intensity of 1,000 movements per day (Cardinaals et al., 2019).

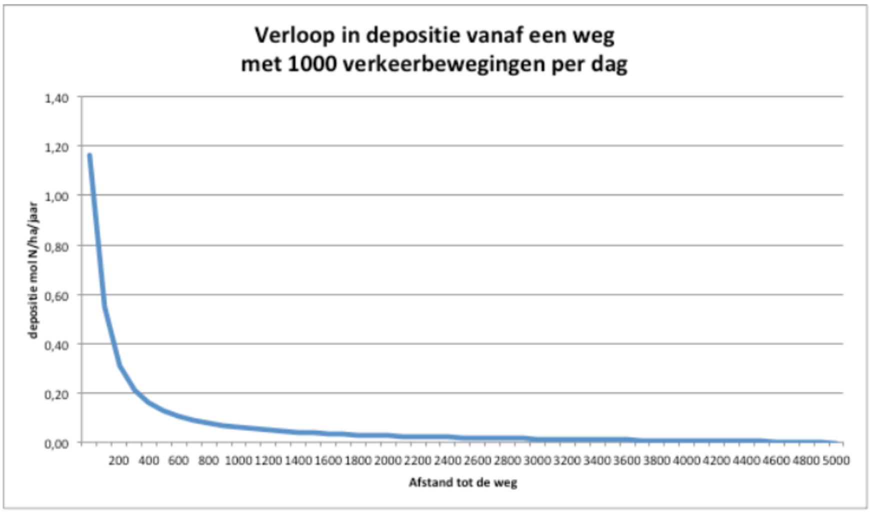

Figure 2: Progression of nitrogen deposition in mol N/ha/year over the distance in kilometers from a road of at least 6 km with a traffic intensity of 1,000 movements per day. The deposition reaches 0.00 mol N/ha/year at a distance of 4.9 km (Cardinaals et al., 2019).

10.2. Appendix 2

The explanation for the approval of the nitrogen calculation for each of the 20 analyzed documents.

20:

The conclusion in the explanation states that only a calculation was made for the operational phase, and the calculation results show <0.005 mol N/ha/year. This corresponds to 200.20 kg/year NOx at a distance of 1.5 km towards a nitrogen-sensitive N2000 area. Due to the absence of a complete calculation for the construction phase, the exact negative impacts cannot be ruled out.

21:

The conclusion states that the Aerius calculation for both the construction and operational phases results in a total deposition of <0.005 mol N/ha/year. However, the same calculation file shows that the impact during the construction phase is 0.01 mol N/ha/year in the Eilandspolder N2000 area. Nevertheless, the environmental permit states: *"The project impact during both the construction and operational phases is at most 0.00 mol/ha/year at all calculation points."* However, the underlying section in the environmental permit indicates that an ecological screening was still conducted, concluding: *"The ecological screening concludes that, as a result of the proposed housing development, negative effects on the adjacent Natura 2000 area Eilandspolder, fish species, and meadow bird species for which the area has been designated can be excluded."*

75:

The calculations for the construction and operational phases show an increase in nitrogen deposition only during the construction phase, with an increase of 0.01 mol N/ha/year. For this reason, an ecological screening was conducted. The assessment states: *"Due to the relatively short duration of the construction activities and developments within the Natura 2000 area (where nitrogen deposition is actually decreasing), and because the nitrogen increase from the construction activities is relatively small, the construction of the 17 houses is not expected to have significant negative consequences, either in the short or long term."* Based on this expectation and the declining deposition value in the peat moss reedlands (H7140B) habitat type, where nitrogen deposition temporarily increases due to the construction phase, negative effects were ruled out.

84:

The calculations for both the construction and operational phases indicate an increase in nitrogen deposition. Even after internal offsetting, deposition in surrounding N2000 areas still increases during the construction phase. As a result, a detailed ecological impact assessment was conducted while the ecological screening was skipped. The detailed ecological impact assessment states: *"The nitrogen deposition increase occurs in only a small portion of the habitat type. Increases >0.10 mol/ha/year occur only in the 11 nearest hexagons, and increases >0.05 mol/ha/year occur only within a 500m radius around the project area."* Despite this temporary increase during the construction phase, it was concluded that there is a permanent decrease in nitrogen deposition due to internal offsetting, ultimately leading to a positive net effect on achieving the conservation objectives of the Noordhollands Duinreservaat.

94:

Aerius calculations show an increase of 0.3 mol N/ha/year in the N2000 area Kennemerland-Zuid. It is not specified whether this increase originates from the construction phase, operational phase, or both. Despite this increase, the project was approved based on notification requirements. The environmental permit clarifies: *"Because housing construction is the main activity in the plan, a notification requirement is not applicable."*

116:

The calculations show that the operational phase does not result in increased nitrogen deposition. However, this project has a permit-free construction phase, meaning an actual increase is not accounted for. Additionally, the project involves the development of 256 ground-level houses (an outlier in Z-score) 2.4 km away from the nearest N2000 area. These three factors suggest that approval based solely on the operational phase, with a net nitrogen deposition increase of >0.00 mol N/ha/year, might not have been achieved.

165:

The Aerius calculations indicate that after internal offsetting, both the construction and operational phases show no increase above 0.00 mol N/ha/year. This implies no increase in nitrogen deposition in N2000 areas. However, the Aerius table only shows a decrease of 0.02 mol N/ha/year in both phases, while data on the baseline and intended deposition levels are missing. Thus, it cannot be ruled out that, despite no recorded increase in nitrogen deposition, the intended situation after internal offsetting still results in a value of ≥0.005 mol N/ha/year.

173:

The construction phase has not been included in the calculation in this document. The conclusion states that: *"For the proposed development plan, no Wnb permit is required for nitrogen deposition."* Furthermore, no nitrogen deposition ≥0.005 mol N/ha/year occurs. However, the effect distance from Cardinaals does not correspond with the development of 80 houses (32 apartments and 48 ground-based homes), which is 8 km. The distance of this project is only 2.6 km towards a nitrogen-sensitive N2000 area. By omitting the construction phase, the exact negative impacts cannot be ruled out.

207:

The conclusion states that the construction phase, over a period of 50 weeks, emits only 1.3 kg/year NOx, while the operational phase emits 1.5 kg/year NOx, at a distance of 1.4 km towards a nitrogen-sensitive N2000 area. This confirms that no nitrogen deposition ≥0.005 mol N/ha/year occurs, which corresponds to the effect distance of Cardinaals.

210:

Aerius calculations indicate that net nitrogen deposition in both the construction and operational phases is 0.00 mol N/ha/year. However, the construction phase is permit-free, or as stated in the document: "n.v.t." (not applicable). Additionally, the project is located within 1 km of an N2000 area, and the calculation is only based on traffic movements during the operational phase. For these reasons, it is notable that the project does not require a permit under the Wnb based on the Aerius calculation.

218:

The conclusion states: "*The proposed development shows that the AERIUS Calculator does not produce results higher than 0.00 mol/ha/year for either phase. Significant impacts on the habitats in Natura 2000 areas due to nitrogen deposition are therefore excluded."* With 14.6 kg/year NOx during the operational phase and 62.9 kg/year NOx during the construction phase, all data is available, and this corresponds to the effect distance of Cardinaals.

228:

The conclusion states that there is no increase greater than 0.00 mol N/ha/year during the operational phase. However, calculations show that emissions in this phase are significantly high, at 8,376.8 kg/year (an outlier in Z-score). Additionally, nitrogen deposition in the operational phase is 2,308.08 mol/ha/year in the Oostelijke Vechtplassen, which is substantial. The calculation also shows a decrease of only 0.01 mol N/ha/year (from 2,308.09 to 2,308.08). The entire report lacks the figures and data on which the calculation is based. It is also stated that the construction phase is permit-free and was not included in the report. Given these inconsistencies, it is remarkable that this project was approved in the first step of the Wnb.

264:

The nitrogen calculation conclusion states that the threshold of 0.005 mol N/ha/year is not exceeded in either the construction or operational phase. This claim is repeated in the final calculations. However, the actual results show that: the construction phase contribution: 0.02 mol N/ha/year and the operational phase contribution: 0.01 mol N/ha/year on the N2000 area Ilperveld, Varkensland, Oostzanerveld & Twiske. Despite these values, the conclusion remains: *"It can be concluded that a nature permit is not required. The results can be submitted to the competent authority for review and verification."* This raises questions regarding the accuracy of the conclusion.

286:

In this project, the Aerius calculation shows that nitrogen deposition in the operational phase is <0.005 mol N/ha/year and does not cause deposition on the N2000 area Ilperveld, Varkensland, Oostzanerveld & Twiske. However, this calculation is only based on traffic movements in the operational phase, while the construction phase is permit-free. Additionally, the project location is within 1 km of an N2000 area. Given these factors, it is remarkable that the project does not require a permit under the Wnb based on the Aerius calculation.

299:

The document's conclusion states that applying for a permit under the Wet Natuurbescherming is not necessary, as the nitrogen contribution from the use of the houses is <0.005 mol N/ha/year. However, this calculation is only based on traffic movements in the operational phase, meaning the construction phase is excluded because it is permit-free. Since the calculation only includes data on traffic movements, it is notable that this project was approved in the first step of the Wnb process.

309:

The nitrogen calculation's conclusion states: *"It is concluded that for both the construction and operational phases, there are no calculated results higher than 0.00 mol/ha/year. Therefore, there is no nitrogen deposition with a significant negative effect on Natura 2000 areas."* However, despite a decrease of 0.09 mol/ha/year, the actual construction phase deposition remains at 0.03 mol N/ha/year. Additionally, in the operational phase, while there is a decrease of 0.05 mol N/ha/year, 0.07 mol N/ha/year is still retained. This raises concerns about potential negative effects on the N2000 area Schoorlse Duinen. Nevertheless, the reduction in deposition through internal offsetting was deemed sufficient for a permit to be granted in step 2 of the Wnb.

353:

The conclusion states that the calculated results do not exceed 0.005 mol N/ha/year. However, the calculation is based only on traffic movements in the operational phase, and the conclusion explicitly states: *"The proposed plan does not lead to additional nitrogen deposition in Natura 2000 areas based* *on the entered data."* Since the construction phase is permit-free, it was not included in the calculation. Due to missing data, it is possible that only including operational traffic movements in the calculation led to a misleading conclusion. Given these limitations, it is notable that this project was approved in step 1 of the Wnb.

358:

The conclusion states that there is no significant increase in nitrogen deposition in the N2000 area, which is located 0.00 km from the project site. However, the calculation is based only on traffic movements in the operational phase, with no mention of the construction phase in the report. Only in the environmental permit is it mentioned that: *"With the recent legislative change, a calculation of the construction phase is no longer necessary."* Given the minimal distance to the N2000 area, it is notable that potential negative effects during the construction phase were disregarded, and that approval was granted for this project based on nitrogen deposition result.

363:

The calculation shows that during the operational phase, there is a nitrogen deposition increase of 0.01 mol N/ha/year on the N2000 area Oostelijke Vechtplassen. Due to this increase, internal offsetting was applied. Based on a calculation relative to current traffic movements, the nitrogen deposition is reduced by 13.19 kg/year, ensuring that the final nitrogen deposition remains <0.005 mol N/ha/year. However, the construction phase was not included in the calculation because it was permit-free. Given that the project is located within 1 km of the Oostelijke Vechtplassen, it is likely that the construction phase also contributed to an increase in nitrogen deposition. It is notable that potential negative effects from the construction phase were ignored.

383:

The nitrogen calculation's conclusion states that over the period 2023-2032, the maximum nitrogen increase from both the construction and operational phases is 0.03 mol N/ha/year in Polder Westzaan. Based on this, the conclusion states that no negative effects on the N2000 area Polder Westzaan can be expected, and a detailed ecological impact assessment was conducted. However, the total nitrogen deposition over the entire period (2023-2032) is actually 0.22 mol N/ha/year, yet only the maximum deposition of 0.03 mol N/ha/year is considered in the report. Additionally, the detailed ecological impact assessment in the environmental permit states: *"There is a (very small) nitrogen contribution due to a change in traffic movements. The ecological assessment indicates that this is a very minor contribution and that nitrogen deposition is not the only determining factor for the habitat quality. Therefore, the nitrogen contribution from the proposed plan does not lead to significant consequences."*

10.3. Appendix 3

The additional tables and figures that are described in the result section.

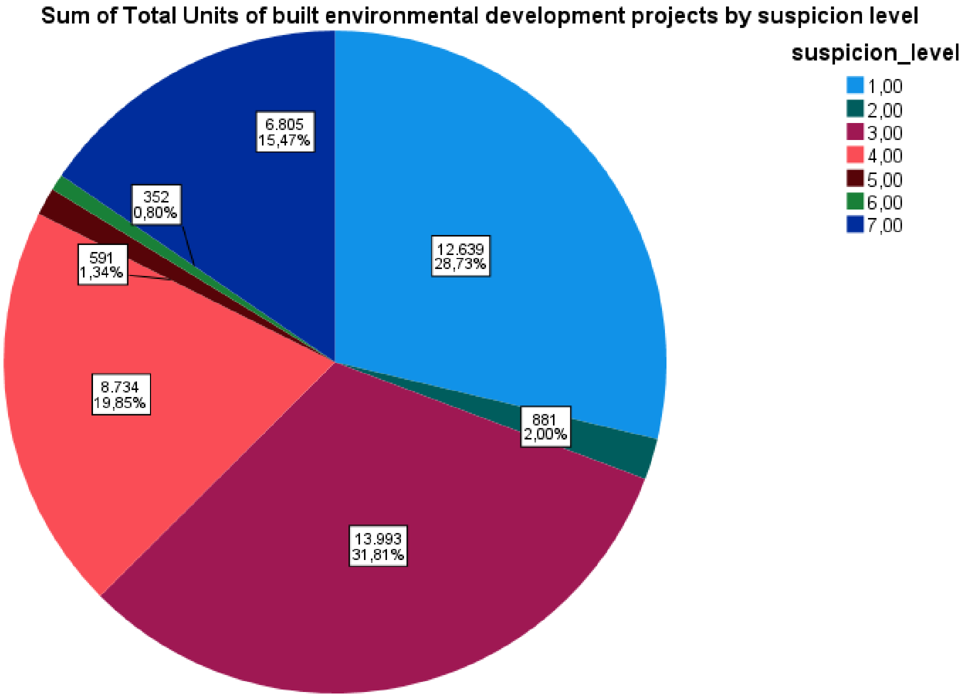

Figure 1: The sum of total units of built environment development projects by suspicion level.

Table 1: The mean of the total units of built environment development projects, and the emissions of NOx during construction and operational phase per suspicion level. The table includes the corresponding number of cases (N) and the standard deviation (std. deviation) for each suspicion level and variable.

	Total Units			Emissions Nox Construction Phase			Emissions NOx Operational Phase		
	Mean	N	Std. deviation	Mean	N	Std. deviation	Mean	N	Std. deviation
Suspicion Level 1	56	226	102.0	148.8	215	171.2	51.2	201	92.4
Suspicion Level 2	44	20	97.6	-	-	-	38.4	17	53.2
Suspicion Level 3	200	70	515.6	315.9	49	652.3	285.9	55	1153.9
Suspicion Level 4	194	45	336.1	600.3	41	1351.7	1155.9	42	4608.5
Suspicion Level 5	59	10	65.4	342.9	7	348.7	49.4	9	87.0
Suspicion Level 6	44	8	57.9	208.8	7	299.5	19.4	6	11.3
Suspicion Level 7	972	7	2311.3	602.2	6	936.8	2328.9	6	5475.4

Table 1: Ordinal regression results of environmental agencies on suspicion levels. The table presents the estimate, standard error, Wald statistic, degrees of freedom (df), significance level (Sig.), and the 95% confidence interval (Lower Bound – Upper Bound) for the predictor variables.

Environmental Agency	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
OD IJmond	0,585	0,356	2,705	1	0,100	-0,112	1,282
OD NHN	-0,403	0,338	1,419	1	0,234	-1,066	0,260
OD NZKG	-0,270	0,358	0,567	1	0,451	-0,972	0,432
OFGV	0[a]			0			

Table 2: Ordinal regression results of company categories on suspicion levels. The table presents the estimate, standard error, Wald statistic, degrees of freedom (df), significance level (Sig.), and the 95% confidence interval (Lower Bound – Upper Bound) for the predictor variables.

Category Company	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Architecture and spatial planning	0,395	0,708	0,311	1	0,577	-0,993	1,783
Construction	1,551	0,922	2,830	1	0,093	-0,256	3,357
Consultancy	0,690	0,632	1,192	1	0,275	-0,549	1,930
Ecology	0,387	0,954	0,164	1	0,685	-1,483	2,256
Engineering	0,869	0,669	1,687	1	0,194	-0,442	2,181
Government	0,813	0,952	0,729	1	0,393	-1,053	2,680
Others	0[a]			0			