

**SPEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA MINISTRY OF HIGHER EDUCATION AND  
SCIENTIFIC RESEARCH**



**UNIVERSITY MOHAMED BOUDIAF M'SILA  
INSTITUTE OF MANAGEMENT AND URBAN  
TECHNIQUES DEPARTMENT OF CITY AND URBANISM**



**BRANCHE: URBANISM**

# **URBAN PLANNING BETWEEN RESTRUCTURING AND ENVIRONMENTAL IMPROVEMENT: A CASE STUDY OF LAND OCCUPANCY PLAN 3 QSABI-CHLEF ,CITY OF TINDOUF**

A dissertation submitted in partial fulfilment of the requirements for the license degree in URBANISM

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**Academic year: 2024/2025**



الجمهورية الجزائرية الديمقراطية الشعبية  
REPUBLIQUE ALGERIENNE DEMOCRATIQUE ET POPULAIRE  
وزارة التعليم العالي والبحث العلمي  
MINISTRE DE L'ENSEIGNEMENT SUPERIEUR ET DE LA RECHERCHE SCIENTIFIQUE  
جامعة محمد بوضياف - المسيلة  
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Institut de Gestion des Techniques Urbaines



ملحق بالقرار رقم 1082 المؤرخ في 27 ديسمبر 2020  
الذي يحدد القواعد المتعلقة بالوقاية من السرقة العلمية ومكافحتها

الجمهورية الجزائرية الديمقراطية الشعبية  
وزارة التعليم العالي والبحث العلمي

مؤسسة التعليم العالي والبحث العلمي : جامعة محمد بوضياف - المسيلة

تصريح شرطي

خاص بالالتزام بقواعد النزاهة العلمية لانجاز بحث

أنا الممضي أسفله:

السيد [ة]: بلخيرى احلام نور الهدى ..... الصفة ( أستاذ، باحث، طالب): طالبة

الحامل (ة) لبطاقة التعريف الوطنية رقم: 110020611047730004 والصادرة بتاريخ: 2020.09.01

المسجل [ة] بكلية /معهد: معهد تسيير التقنيات الحضرية | قسم: العمران

و المكلف [ة] بانجاز أعمال بحث [مذكرة التخرج، مذكرة ماستر، مذكرة ماجستير، أطروحة دكتوراه]

عنوانها: .....

URBAN PLANNING BETWEEN RESTRUCTURING AND ENVIRONMENTAL IMPROVEMENT: A  
CASE STUDY OF LAND OCCUPANCY PLAN 3 QSABI-CHLEF, CITY OF TINDOUF

أصريح بشرطي أنني ألتزم بمراعاة المعايير العلمية والمنهجية ومعايير الأخلاقيات المهنية والتزامه الأكاديمية المطلوبة في انجاز  
البحث المذكور أعلاه.

التاريخ: 10.06.2025

توقيع المعني [ة]

## **thesis abstract**

Urban planning is the discipline concerned with organizing and managing land use to ensure sustainable, functional, and liveable urban environments.

This research focuses on the land occupancy plan 3 QSabi-Chlif neighbourhood in the city of Tindouf, Algeria.

The choice of Tindouf stems from the absence of prior urban planning studies in the area, despite rapid urban expansion.

QSabi was selected due to its evident environmental degradation and disorganized urban growth.

The main problem identified is the lack of structured urban planning, resulting in poor road conditions, limited green spaces, environmental pollution, and unregulated parking and flood risk.

The existence of these issues was confirmed through field surveys, photographic documentation, analysis of satellite images, and official municipal data.

The proposed interventions include :

- Creating green spaces
- Converting the main commercial road into a pedestrian-only zone
- relocating solid waste depot to reduce pollution
- rehabilitating the road network
- Reducing environmental risks, including flood exposure

The proposals are grounded in Algerian urban planning regulations and UN-Habitat urban development principles.

This study provides the first structured urban intervention proposal for this neighbourhood and highlights a replicable approach for similar underserved urban areas.

## ملخص

يُعنى التخطيط الحضري بتنظيم استخدامات الأراضي لضمان بيئة حضرية مستدامة، وظيفية، وصالحة للعيش.

تتناول هذه الدراسة مخطط شغل الاراضي 3-حي قصابي شلف بمدينة تندوف في الجزائر وتم اختيار مدينة تندوف لغياب الدراسات التخطيطية السابقة رغم توسعها العمراني، واختير فكان بسبب مظاهر التدهور البيئي الواضحة فيه، وتوسع عمراني غير منظم يزيد من حدة الفيضانات ويهدد جودة البيئة الحضرية

تكمن المشكلة الرئيسية في غياب تخطيط حضري منظم، مما أدى إلى تدهور حالة الطرق، ندرة المساحات الخضراء، التلوث البيئي، وفوضى مواقف السيارات العشوائية و تواجد حظيرة ولائية في مركز المدينة.

تم التحقق من هذه المشاكل من خلال العمل الميداني، التوثيق الفوتوغرافي، تحليل الصور الفضائية، والبيانات الرسمية للبلدية , كما تشمل التدخلات المقترحة:

- إنشاء مساحات خضراء
- تحويل الطريق التجاري الرئيسي إلى منطقة للمشاة فقط
- نقل الحظيرة الوطنية لتقليل التلوث و تحويلها الى حديقة
- إعادة تأهيل شبكة الطرق
- الحد من المخاطر البيئية، خاصة الفيضانات

استندت المقترحات إلى القوانين الجزائرية الخاصة بالتخطيط الحضري ومبادئ تخطيط المدن التابع للأمم المتحدة.

تقدم هذه الدراسة أول تصور تخطيطي مهيكّل لهذا الحي، وتفتح المجال لتطبيق النموذج في مناطق حضرية مشابهة.

## Résumé

L'urbanisme est une discipline qui vise à organiser l'utilisation du sol afin d'assurer un environnement urbain durable, fonctionnel et habitable.

Cette étude porte sur le Plan d'Occupation des Sols n°3, quartier Kasabi-Chlef, situé dans la ville de Tindouf, en Algérie. Le choix de Tindouf s'explique par l'absence d'études urbanistiques antérieures malgré une expansion urbaine rapide. Le quartier a été sélectionné en raison d'une dégradation environnementale visible et d'un développement non planifié qui aggrave les risques d'inondation et compromet la qualité de l'environnement urbain.

Le principal problème identifié est l'absence de planification urbaine structurée, entraînant la dégradation du réseau routier, le manque d'espaces verts, une pollution environnementale marquée, un stationnement anarchique, ainsi que la présence d'un parc provincial au centre-ville.

Ces constats ont été confirmés à travers un travail de terrain, une documentation photographique, l'analyse d'images satellites et des données officielles de la commune.

Les interventions proposées comprennent :

- La création d'espaces verts
- La transformation de la voie commerciale principale en zone piétonne
- Le déplacement du parc provincial hors du centre et sa reconversion en espace vert
- La réhabilitation du réseau routier
- La réduction des risques environnementaux, notamment les inondations

Les propositions s'appuient sur la législation algérienne en matière d'urbanisme et sur les principes du programme ONU-Habitat.

Cette étude constitue la première proposition d'aménagement structurée pour ce quartier et offre une méthodologie reproductible dans d'autres contextes urbains similaires.

## كلمة شكر وعرقان

الحمد لله الذي علم بالعلم، علم الإنسان ما لم يعلم، وبفضله وحده نبليح ما نطمح إليه، ونتجاوز الصعاب. أتقدم بجزيل الشكر والامتنان إلى كل من كان له دور مباشر أو غير مباشر في إنجاز هذا العمل الأكاديمي، علمًا، دعمًا، أو تعاوًا ميدانيًا. أشكر أساتذتي الكرام الذين ساهموا في تكوين خلفيتي العلمية على ما قدموه من دعم وتوجيهات، سواء خلال فترة البحث أو في مختلف مراحل التكوين الجامع و اخص بالذر الأستاذة المؤطرين الأستاذة هويدب حنان و الأستاذ بركات زين العابدين.. أتوجه بخالص التقدير والامتنان لوالديّ العزيزين، على ما بذلاه من دعاء، دعم، صبر، وتضحيات طوال مسيرتي التعليمية. كما أخص بالشكر أخي الذي رافقتني فعليًا في هذه التجربة، ورافقتني في رحلتي الميدانية الطويلة من الجزائر العاصمة إلى ولاية تندوف، وكان عونًا لي في كل التفاصيل الميدانية والإدارية لا يفوتني أن أعبر عن امتناني لأصدقائي الذين قدموا لي دعمًا نفسيًا وماديًا كان له الأثر البالغ في استمرارتي، وعلى رأسهم سلمي الاء و عاشوري هاجر و مناني اية مارية.

أتمنّ عاليًا تعاون عدد من المسؤولين والموظفين المحليين في ولاية تندوف، الذين سهّلوا عملية البحث الميداني، وفتحوا لي الأبواب، وأمدوني بالبيانات والمعلومات الضرورية، ومنهم:

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- سدور محمد رئيس مصلحة التعمير (مديرية التعمير والهندسة المعمارية والبناء - ولاية تندوف)
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- السيد شريف (مديرية الموارد المائية - ولاية تندوف)
- السيد موقفي أحمد مهندس معماري وصاحب مكتب دراسات - ولاية المدية
- الأستاذ حفيان انور رئيس مصلحة الهندسة المعمارية و البناء (مديرية التعمير والهندسة المعمارية والبناء - ولاية تندوف)
- حيداس حميدة مدير الديوان الوطني للحظيرة الثقافية لتندوف

وكل من ساعدني من الإدارات والمؤسسات المحلية ولو بمعلومة أو توجيه

أعبر عن تقديري وامتناني الكيرين للعائلتين الكريمتين عائلة بياض و عائلة أبغاش اللتين استقبلتنا أثناء العمل الميداني، ووفرتا لنا ظروفًا إنسانية مريحة.

ولا يفوتني أن أعبر عن خالص امتناني لعائلة نادي RISE للمحادثة باللغة الإنجليزية، على دعمهم المستمر، وتحفيزهم الدائم، ووقوفهم بجانبني طيلة مسيرتي، فقد كانوا مصدر قوة في لحظات التعب والتردد.

أتقدم بالشكر لزملائي في الدراسة والميدان، الذين شاركوني هذه التجربة، وساندوني سواء في التحضير، أو في التوجيه، أو في الجهد الجماعي الميداني.

أشكر كل من قدم لي دعوة صادقة، أو كلمة مشجعة، أو حضر معي لحظة من لحظات التعب أو الإنجاز.

لكم جميعاً، كل الامتنان والتقدير، فنجاح هذا العمل هو ثمرة لجهودكم وتعاونكم.

## DEDICATION

To **Gaza**.

To its people who live under the sky of fire.

To its martyrs who walked to death with courage.

To every child who slept hungry.

To every mother who buried her son.

To every soul that still says “we are alive.”

I dedicate this work to you.

This is not enough.

But it’s a drop in the ocean of what you deserve.

I pray that Allah accepts it as a small deed in your name,  
and makes us among those who rebuild your land with justice and  
peace.

"وَمَا تَفْعَلُوا مِنْ خَيْرٍ فَإِنَّ اللَّهَ بِهِ عَلِيمٌ"

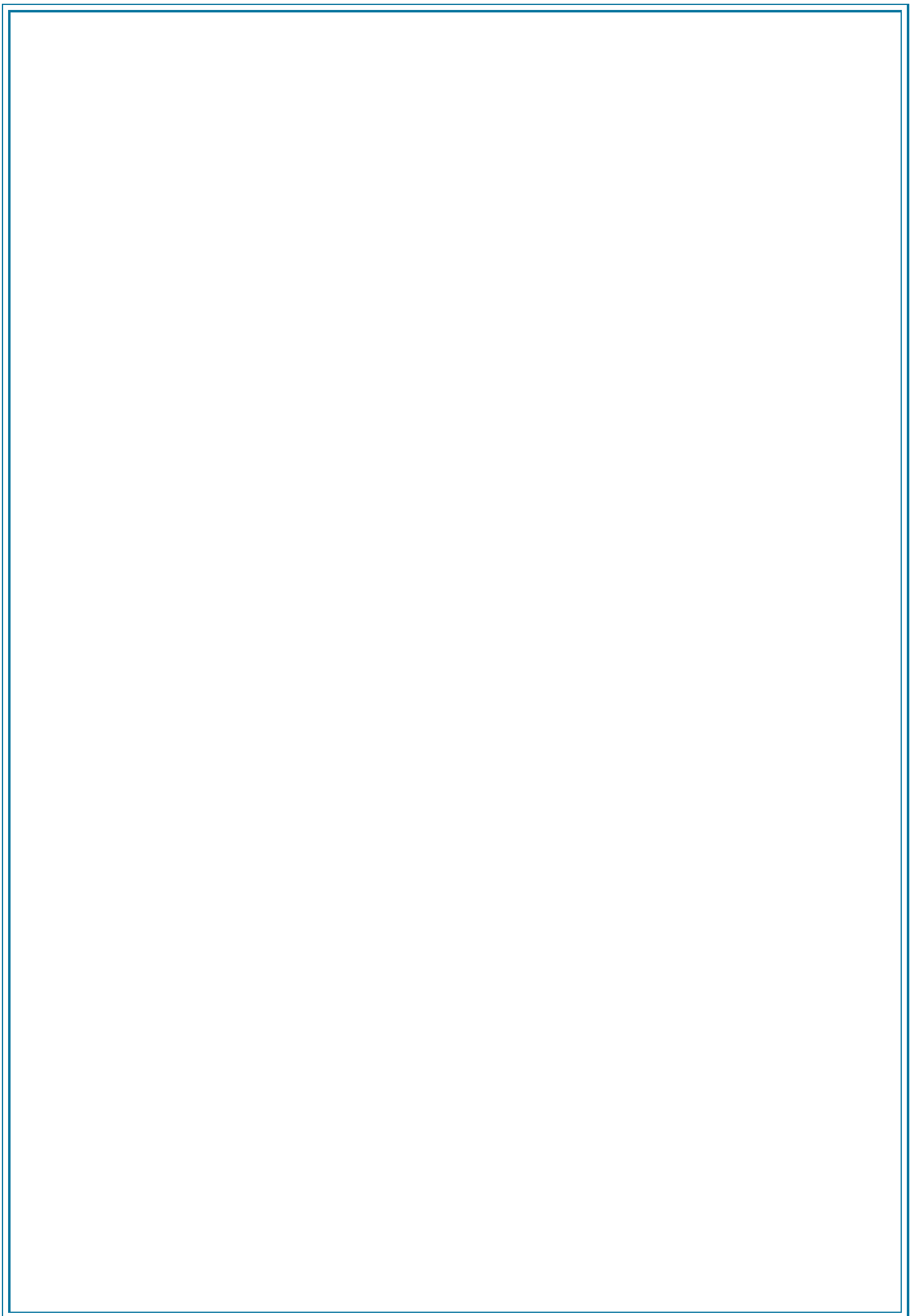
*“Whatever good you do, Allah is aware of it.” (Qur’an 2:215)*

"وَلَا تَحْسَبَنَّ الَّذِينَ قُتِلُوا فِي سَبِيلِ اللَّهِ أَمْوَاتًا بَلْ أحيَاءٌ عِنْدَ رَبِّهِمْ يُرْزَقُونَ"

*“Never think of those who are killed in the path of Allah as dead.  
They are alive, receiving provision from their Lord.” (Qur’an  
3:169)*

May Allah use us to bring light where darkness ruled.

May He not let their blood be wasted.



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## **Introduction:**

Urban planning plays a crucial role in shaping the quality of life in cities by addressing mobility, environmental concerns, and public space management. In Tindouf, urban studies have largely been overlooked, with most research focusing on geology and soil conditions rather than city planning and development. This study is the first to analyze and propose urban interventions for Ksabi - Chilif Neighborhood, a growing area facing several urban challenges.

Despite having basic infrastructure, the neighborhood struggles with lack of green spaces, and environmental issues such as pollution and flood risks.

"Salam Alaikum Road," a key commercial street, suffers from congestion and limited pedestrian accessibility. Additionally, wilaya depots located within the urban core contribute to pollution and inefficient land use. These issues negatively impact residents' daily lives and limit the neighborhood's potential for sustainable development.

This research aims to assess the existing urban structure and propose practical solutions to improve mobility, enhance public spaces, and mitigate environmental risks.

By focusing on these aspects, this research seeks to provide a foundation for future urban planning initiatives in Tindouf, offering insights that could influence policy decisions and improve overall urban livability in the region.

## **1. Background of the Study**

Tindouf is located in the far southwest of Algeria. The region is characterized by extreme arid conditions and harsh climate. These environmental factors shape the living conditions and urban dynamics of the area.

Previous research has mainly focused on geological and soil characteristics. Urban planning studies remain largely unexplored. There is a lack of academic attention to urban organization, mobility issues, environmental problems, and the quality of urban life in this region.

## **2. Statement of the Problem**

Despite having essential infrastructure, Ksabi - Chilif Neighborhood in Tindouf faces several urban challenges that affect residents' quality of life. Poor road conditions, lack of green spaces, environmental risks, and inefficient land use create an unsustainable urban environment. These issues require urgent attention to improve mobility, public space utilization, and environmental resilience.

### **➤ Poor Road Conditions**

-“Salam Alaikum Road,” a major commercial street, is congested and lacks pedestrian-friendly infrastructure.

### **➤ Lack of Proper Public Spaces**

-Green spaces and recreational areas are planned but remain unimplemented

-Underutilized spaces in the neighborhood could be transformed into functional public areas.

### **➤ Flood Risk Due to the Nearby Valley**

-The neighborhood is highly vulnerable to floods, which threaten buildings and public infrastructure.

-The absence of a proper drainage system increases the severity of flooding.

➤ **Environmental Degradation and Pollution:**

- Poor waste management leads to garbage accumulation, affecting public health and the urban environment.
- The presence of wilaya depots within the city contributes to pollution and inefficient land use.

These problems highlight the need for comprehensive urban planning solutions. Addressing these challenges through road restructuring, pedestrian-friendly areas, improved green spaces, and sustainable waste management will enhance the neighborhood's livability and resilience. This study aims to develop urban interventions that optimize land use, promote environmental sustainability, and create a more functional urban space in Ksabi - Chilif Neighborhood.

### **3. Research Questions:**

This study aims to address key urban challenges in Ksabi - Chilif Neighborhood by improving mobility, public spaces, and environmental resilience. The following research questions guide the analysis and proposed interventions:

**Main Research Question:**

- What urban interventions can improve mobility and the use of public spaces in Ksabi - Chilif, while addressing environmental concerns?

**Suggested Sub-questions:**

1. What are the main challenges the neighborhood faces in terms of infrastructure and mobility?
2. How can underutilized spaces and green areas be enhanced to serve the community better?
3. What is the impact of flooding on the neighborhood, and what mitigation measures can be proposed?
4. How can sustainable urban planning contribute to improving the quality of life in the area?

These research questions form the basis for analyzing existing conditions and proposing sustainable urban interventions to improve quality of life in Ksabi - Chilif Neighborhood.

#### **4. Purpose of the Study:**

This study aims to analyze and improve the urban structure of Ksabi - Chilif Neighborhood in Tindouf by addressing challenges related to mobility, public spaces, environmental risks, and urban functionality. Despite having the necessary infrastructure, the neighborhood faces issues such as poor road conditions, congestion, a lack of green spaces, and environmental hazards like flooding and pollution. This research seeks to assess the current urban condition, identify deficiencies in road infrastructure and land use, and propose sustainable interventions to enhance livability and safety. Key objectives include restructuring the road network to improve accessibility, transforming “Salam Alaikum Road” into a pedestrian-friendly commercial street, optimizing parking locations, and integrating functional green spaces. Additionally, the study aims to analyze flood risks, evaluate the impact of salt weathering on buildings, and develop strategies to improve urban resilience. Another important aspect is the relocation of wilaya depots to reduce pollution and enhance land use efficiency while proposing better waste management systems to improve environmental

quality. By focusing on these urban interventions, the study provides practical solutions to enhance the neighborhood's sustainability, functionality, and overall quality of life.

## 5. Research Objectives:

- **Assess the Current Urban Condition:** Roads, green spaces, public infrastructure.
- **Evaluate Environmental and Geological Risks:** Flood risks and soil conditions.
- **Propose Urban Restructuring Strategies:** Pedestrian-friendly roads, green spaces, and improved public areas.
- **Improve Waste Management:** Develop efficient garbage collection and pollution control measures.
- **Develop a Sustainable Urban Plan:** Ensure future growth follows sustainable principles.

## 6. Research Methodology:

- **Data Collection:** Field observations, interviews, GIS mapping.
- **Urban Analysis:** Road conditions, land use, environmental impact assessment.
- **Case Study Comparison:** Reviewing similar urban projects for reference.
- **Proposal Development:** Designing solutions for road restructuring, green spaces, and waste management

URBAN PLANNING IS NOT ABOUT IMAGES BUT IS A WAY TO MAKE A DIFFERENCE; IT IS A FRAMEWORK THAT HELPS LEADERS TRANSFORM A VISION INTO REALITY USING SPACE AS A KEY RESOURCE FOR DEVELOPMENT AND ENGAGING STAKEHOLDERS ALONG THE WAY.

Pablo Vaggione-Urban planning for city leaders

# CHAPTER 1: URBAN PLANNING TERMINOLOGY

## **Introduction:**

This chapter defines key terms used in the thesis. It introduces basic concepts in urbanism, urban planning, and urbanization, as well as terms related to environmental risks. It also presents the main urban planning tools used in Algeria, based on national law and practice. These definitions build the foundation for the study.

## **Section 1: Concepts Related to Urbanism, Urbanization, and Urban Planning:**

### **Urbanism:**

Urbanism is the study of the characteristics, growth, and development of cities and towns. It includes the social, cultural, economic, and spatial structures that define urban life. Urbanism also refers to the ideology of urban living and the planning and policy decisions that shape urban form. Scholars use this term to analyze patterns of urbanization, infrastructure systems, and governance.<sup>1</sup>

### **Urban Design:**

Urban design is the art and science of shaping the physical features of cities and towns. It bridges architecture, landscape, and planning by focusing on the design of public spaces, the arrangement of buildings, street networks, and the human-scale experience of the built environment. Good urban design fosters social interaction, walkability, identity, and sustainability.<sup>2</sup>

### **Urban Planning:**

Urban planning is a professional discipline concerned with the design, development, and organization of urban spaces. It involves land use regulation,

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<sup>1</sup> Hutchison, R. (Ed.). (2009). *Urbanism*. In *Encyclopedia of Urban Studies* (Vol. 2, p. 925). Sage Publications.

<sup>2</sup> Carmona, M., Heath, T., Oc, T., & Tiesdell, S. (2010). *Public Places, Urban Spaces: The Dimensions of Urban Design*. Routledge. p.3

transportation planning, infrastructure development, environmental protection, and public participation. The goal is to create sustainable, functional, and inclusive urban environments that support the needs of current and future populations.<sup>1</sup>

### **Urbanization:**

Urbanization is the process through which rural areas transform into urban areas, leading to an increase in the proportion of people living in cities. It is associated with industrialization, migration, and changes in lifestyle.<sup>2</sup>

### **Resilience in Urban Planning:**

Resilience in urban planning refers to the ability of cities to adapt to and recover from adverse events such as natural disasters, climate change, or economic downturns. It focuses on creating infrastructure, policies, and designs that minimize vulnerability and enhance recovery capabilities<sup>3</sup>

### **Public Spaces:**

Public spaces are areas in cities that are accessible and open to all individuals, including parks, squares, streets, and recreational facilities. These spaces play a key role in social interaction, community-building, and urban identity.<sup>4</sup>

### **Land Use Planning:**

Land use planning is the process of determining the most appropriate uses of land based on its physical, environmental, and social characteristics. It aims to regulate development, conserve resources, and ensure compatible land uses.<sup>5</sup>

### **Zoning:**

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<sup>1</sup> Levy, J. M. (2013). *Contemporary Urban Planning*. Routledge.

<sup>2</sup> Ginsburg, N., et al. (2018). *Urbanization in Developing Countries*. Springer.

<sup>3</sup> Newman, P., & Jennings, I. (2008). *Sustainable Urban Planning: Building Resilience in Cities*. Earthscan, Page 75.

<sup>4</sup> Carmona, M., Heath, T., Oc, T., & Tiesdell, S. (2010). *Public Places, Urban Spaces: The Dimensions of Urban Design*. Routledge, Page 15.

<sup>5</sup> Hall, P. (2002). *Urban and Regional Planning*. Routledge, Page 93.

Zoning is a land-use regulation tool that divides urban areas into specific zones, each designated for particular uses such as residential, commercial, industrial, or recreational purposes. Zoning helps control urban growth, maintain property values, and protect the environment.<sup>1</sup>

### **Sustainable Development:**

Sustainable development in urban planning is the approach to creating cities that balance economic growth, social inclusion, and environmental protection. It involves minimizing resource consumption, reducing environmental harm, and ensuring that urban growth is equitable and resilient for future generations.<sup>2</sup>

## **Section 2: Concepts Specific to Environment and Risks:**

### **Risk:**

Risk is the combination of the probability of a hazardous event occurring and the severity of its potential consequences on people, property, or the environment. In urban and environmental planning, risk is typically assessed by analyzing three components: hazard, exposure, and vulnerability. It is used as a tool for decision-making in disaster risk management, environmental planning, and public policy.<sup>3</sup>

### **Environment:**

The environment is the external physical, chemical, and biological conditions and surroundings that affect the growth, development, and survival of organisms. In urban studies, it refers to both the natural systems (air, water, land, ecosystems)<sup>4</sup> and the built environment (infrastructure, housing, industry) in which people live

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<sup>1</sup> Fischel, W. A. (2015). *The Economics of Zoning*. Journal of Urban Economics, Page 45.

<sup>2</sup> Brundtland, G. H. (1987). *Our Common Future*. Oxford University Press, Page 43.

<sup>3</sup> United Nations Office for Disaster Risk Reduction (UNDRR). (2009). *UNISDR Terminology on Disaster Risk Reduction*, p. 25.

<sup>4</sup>

and interact. It includes all elements that shape human life, health, and well-being and is central to sustainable development and urban planning.<sup>1</sup>

### **Environmental Sustainability:**

Environmental sustainability refers to the ability to maintain the health of the environment over time, ensuring that natural resources are used efficiently and responsibly.<sup>2</sup>

### **Flood Risk:**

Flood risk is the potential for a flood to cause harm to people, property, and infrastructure. It depends on factors like flood probability, vulnerability of the area, and flood mitigation measures in place.<sup>3</sup>

### **Flood Hazard:**

Flood hazard refers to the likelihood of a flood occurring in a specific area. It is determined by the frequency and intensity of flooding events in that region.<sup>4</sup>

## **Section 3: Concepts Specific to the Algerian Urban Context:**

### **1. National Urbanization Plan (SNAT):**

The National Urbanization Plan reflects the perspective of the future occupation of the national territory, considering the long-term socio-economic and cultural development strategy. Among its tasks are:

- The realization of the decisions made regarding the development and organization of the national space.
- The indicative framework for the distribution and location of development works.

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<sup>1</sup> Miller, G. T., & Spoolman, S. E. (2012). *Living in the Environment: Principles, Connections, and Solutions*. 17th edition. Cengage Learning, p. 5.

<sup>2</sup> Gray, J., & Bennett, A. (2003). *Environmental Sustainability and Development*. Routledge, Page 112.

<sup>3</sup> Smith, K. (2013). *Environmental Hazards: Assessing Risk and Reducing Disaster*. Routledge, Page 118.

<sup>4</sup> Sayers, P. B., et al. (2016). *Flood Risk Management: A Strategic Approach*. Springer, Page 150.

- Defining the rules for the preparation of all national and multidimensional development plans in their economic dimension and aspects.
- Intersectoral consultation and inter-regional coordination frameworks.

### **1.1.Preparation of the SNAT Plan:**

This plan is prepared at the highest level of the structures responsible for urbanization, in coordination with the administration, and serves as the basis for the country's overall strategy.

### **2. Regional Urbanization Plan (SRAT):**

This is a tool for simplifying and adapting the development work outlined in the national plan, ensuring accuracy in selecting options, reducing regional disparities, fostering integration among regions, encouraging development, and preparing for the long term, in a timeframe parallel to that of the national plan.

### **3. State Development Plan PAW:**

The regional development plan for the state is a means of implementing the national plan and detailing the regional plan followed by the concerned state, it is prepared at the level of the National Agency for Urban Planning, to ensure the implementation of the planned processing and investment operations by the state, and to draw this plan, maps needed by the state are prepared, including:

- Map of the administrative boundaries of municipalities and districts.
- Physical map showing the most important landforms
- A climate map helps the agronomist in choosing products and general agricultural trends, and the architect in the use and selection of building materials.
- A map that organizes networks, roads, electricity, gas, and the concentration of industrial and rural areas.

These are all important means of knowing the social and economic needs of the population.

#### **4. PDAU is the master plan for urbanization and development:**

A tool for spatial planning and urban management. It defines the basic orientations for the urbanization of the municipality or municipalities concerned, as well as the Land for economic activities of general interest and construction to determine current and future needs for public facilities, which is long term from 15 to 20 years, as it also designates private sectors for urbanization and defines P.O.S. land occupation schemes (P.O.S.).

Consists of:

##### **A. Rapport**, in which the following are presented:

- Analyze the current situation and the main prospects for development considering the economic, social and cultural developments of the territory in question
- The proposed configuration pattern considering the urbanization directive

**B. Regulation:** specifies the rules applicable to each occupied area in the sectors as follows It is defined in Articles 23-22-20 of Law 29/90 of December 01, 1990 on Planning and Construction:

- The predominant specialization of the land and the type of business that has been subjected to special conditions.
- The general density resulting from the land occupation coefficient.
- Easements to be maintained, modified or created.
- Areas with land occupation plans with their associated reference boundaries by highlighting the areas of intervention in the urban fabric and the spaces to be protected.

- Determining the locations, major installations, basic facilities, services and works and their type, and specifying in addition to that the special construction conditions within some ordinance parts.

**C. Graphic documents:** These include the following charts:

- The existing plan shows the existing framework and the various roads and networks.
- Layout plan and shows the following:
  - Durable sectors /Reconstructable/Designated for future reconstruction /Unreconstructable
  - Some parts of the land: the coastline, high-potential and good agricultural land, and land with prominent natural and cultural features.
  - Areas entering occupation schemes
- Outline of easements: Must be maintained, modified, or created.
- Facilities plan: It shows the lines of road traffic and the best ways to deliver drinking water and sanitation water, as well as the location of collective equipment and public utility installations.

#### **4.1.Its objectives:**

The PDAU determines the general allocation of land on the entire territory of the municipality or a group of concerned municipalities depending on the sector. - It determines the expansion of residential buildings, the concentration of interests and activities, and the location of major equipment and infrastructure.

- Defines the areas of intervention in the urban fabric and the areas to be protected.
- The intervention area is divided into sectors and knowledge as follows:
  - Durable Sectors
  - Reconstructable Sectors
  - Unreconstructable Sectors.

## **Cases of its intervention:**

**1 Perennial Sectors:** It includes all land, even if it is not equipped with all facilities, occupied by clustered buildings, separation spaces or unbuilt spaces such as green spaces, gardens, parks, free spaces and urban forests, and also includes parts to be identified, repaired or protected.

**2 Sectors programmed for reconstruction:** These include the sectors allocated for construction in the short and medium term and the 10-year horizon according to the priorities stipulated.

**3 Future Development Sectors:** These include lands allocated for long-term development over a 20-year horizon according to the stipulated deadlines, and all lands located for future development sectors are temporarily subject to an easement not to build, and these easements are only lifted for lands that enter into the implementation of the approved land occupation plan.

**4 Non-developable sectors:** These are the sectors in which building rights can be stipulated and precisely defined in proportions that are consistent with the general economy of the areas of these sectors.

## **5. The land occupation plan POS:**

is a spatial planning and urban management tool that defines in detail the land use and building rights within the framework of the PDAU. The land occupation plan consists of the following:

- A- submission memorandum proving the compatibility of the land occupation provisions with the provisions of the PDAU plan as well as the approved program for the municipality or municipalities concerned according to their development prospects.
- B- Part of the rules that define each homogeneous area taking into account the special provisions applicable to some parts of the territory as defined in

Chapter IV of Law No. 29/90 of December 1, 1990: The type of authorized and prohibited buildings, their destination and the building rights associated with the ownership of Land expressed in terms of land occupancy coefficient and land area coefficient (CES / COS) with all possible easements.

C- The land occupancy factor in this case determines the relationship between the area of the land with all construction and the area of the plot - Floor areas with associated raw construction equal to the sum of the floor areas of each construction level minus them.

- Ground areas with associated roof timbers and underground floors that are not adaptable or activities of a professional, craft, industrial or commercial nature.

- Floor spaces with related roofs, surfaces, balconies and compartments, as well as unenclosed spaces located on the ground floor.

- Ground areas with associated buildings that are intended to be used as parking lots.

The types of authorized and prohibited buildings, their intended use, and the

**D- Regulation:** Shows the same land occupancy conditions associated with the following:

/1 Ports and roads.

/2 Network access.

/3 Plot characteristics.

/4 Location of buildings in relation to public roads and those related to them.

/5 Location of buildings in relation to the boundaries separating them.

/6 Location of buildings from each other on one property.

/7 Height of buildings.

/8 Exterior appearances.

/9 Parking.

/10 Empty spaces and mattresses.

**E- Graphic documents consist of the following in particular:**

-1 Location chart at a 1/2000 or 1/5000 scale

-2 A topographic plan at a scale of 1/500 or 1/1000

-3 A map at a scale of 1/500 or 1/1000 showing the geotechnical laws for the urbanization of the territory in question, accompanied by a technical report.

-4 Reality chart at a 1/500 or 1/1000 scale showing the currently constructed framework, roads, and various networks and existing easements.

-5 A general configuration chart at a scale of 1/500 or 1/1000 that identifies the following: -zones legal homogeneous

- The location of installations of public interest and benefit.

- The line of passage of various roads and networks, highlighting what the state bears as defined by PDAU and what is borne by local communities.

- Areas to be preserved due to their specificity.

-6 An urban structure plan on a scale of 1/500 or 1/1000 that includes, in particular, the elements of the regulation accompanied by an interrogation that embodies the desired architectural forms for the sector in question, excluding the site plan. All the mentioned plans are mandatorily prepared at a scale of 1/500 if the land occupation plan concerns the

**Summary:**

Chapter 1 offers a general overview of essential urban planning terms and explains concepts like zoning, resilience, risk, and sustainability. It also covers Algeria's main urban tools: SNAT, SRAT, PAW, PDAU, and POS. The chapter helps clarify the terminology that will be used throughout the thesis.

CHAPTER 2: THE CITY OF TINDOUF:  
URBAN CHARACTERISTICS AND  
DEVELOPMENT

## **Introduction :**

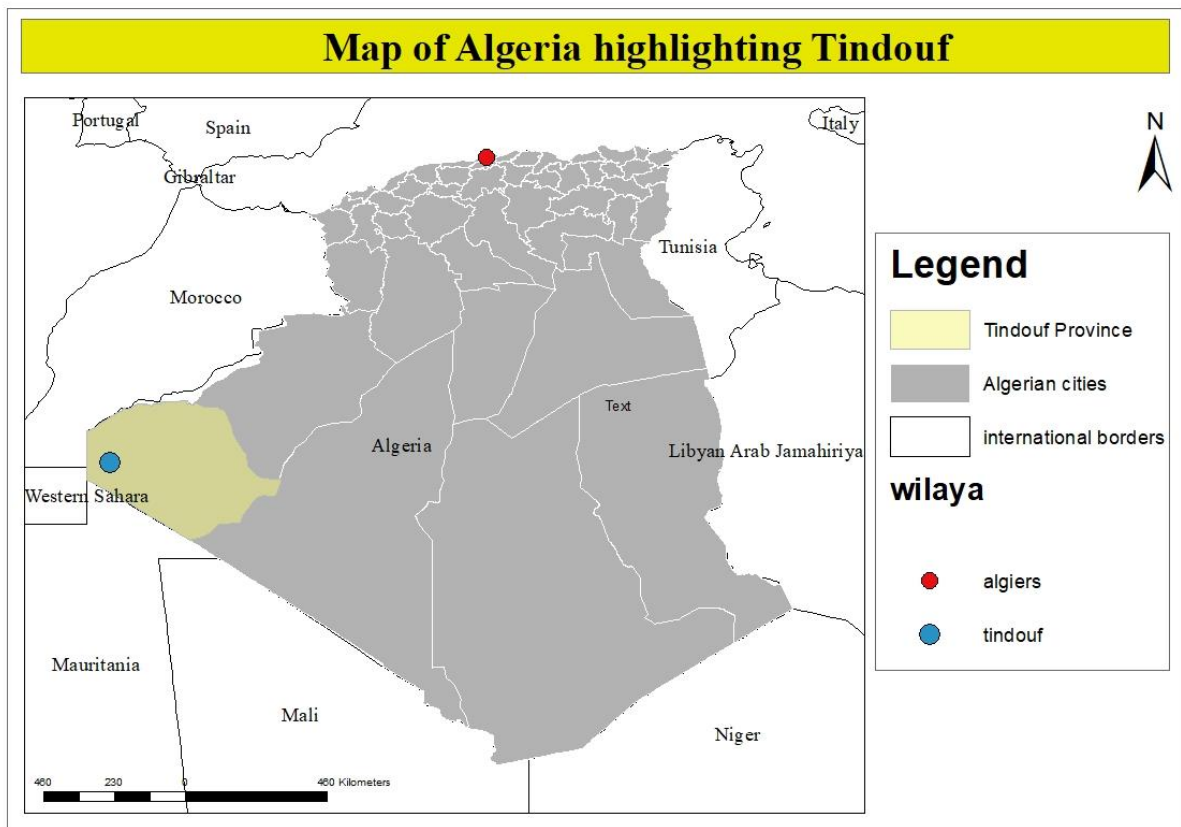
Understanding the geographic and urban context of a city is essential for diagnosing spatial issues and proposing relevant planning interventions. This chapter presents a structured overview of the study area, starting with the province of Tindouf, followed by a focus on the Tindouf Commune, and finally narrowing down to Occupation Land No. 3, the specific neighborhood chosen for field research.

The goal is to identify the key characteristics of the urban structure, including demographic patterns, spatial organization, infrastructure networks, and ongoing urban dynamics. This contextual analysis forms the foundation for interpreting the environmental and planning challenges addressed in the following chapter.

## **I. PRESENTATION OF THE TINDOUF PROVINCE**

### **1. GEOGRAPHICAL LOCATION**

Tindouf is located in the far south of Algeria, approximately 2000 km from the capital. It is bordered to the north by the Béchar province, to the south by Mauritania, to the east by the Moroccan border, and to the west by the Western Sahara. It covers an area of about 158,000 square kilometers, representing 6.67% of the country's total area. It was elevated to the status of a province according to the 1984 administrative division. It comprises two municipalities: “Oum Laâssel” and “Tindouf.”



*Figure 1 Map of Algeria highlighting Tindouf, created by the student*

### **2. HISTORICAL OVERVIEW OF TINDOUF:**

The foundation of Tindouf dates back to the 16th century. Due to its strategic location, Tindouf has historically played an important role in trade and cultural

exchange. It has been a crossroads for various historical movements in the southern Maghreb and has been a center for resistance against colonial forces.

It served as a hub and a crossroads for trade caravans traversing the southern Algerian Sahara from regions such as the far Maghreb, Western Sahara, Mauritania, and Mali. This role was revitalized after the restoration of national sovereignty through the international trade route, which was known in the province as "El Maghreb."

Tindouf, like other regions of the country, experienced popular resistance against French colonial rule, including the Battle of Merkala in September 1956, approximately 90 km north of Tindouf, and the battles of Hassi Mounir and Am Lashar.<sup>1</sup>



*Figure 2 Le K'sar de Hai Moussani, Tindouf*

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<sup>1</sup> Cultural Park of Tindouf, prepared by: Hamida Heidas (texts and supervision), Mohamed Bouskin (maps, photos), Yahia Cherif (design). Tindouf, Algeria.

### **3. ORIGIN OF THE NAME TINDOUF**

The city of Tindouf is known by three distinct interpretations, which we will briefly review:

- Tindouf: In its interpretation, it means a region that is visited from all directions due to its commercial, scientific, and strategic importance. Historically, Tindouf was a stop for caravans on trade routes and a scientific center.
- Tinfouf: This word is divided into two parts: "Tin" refers to a spring that flows with water, and "fouf" means that this spring flows underground.
- Tind fos: As mentioned by "Al-Buqri" in the book "Al-Masalik wa Al-Mamalik," he says: "It is a center of Sadaou, where travelers rest, and it does not take long for it to flourish and thrive. It is located south of the Draa Hamada, overlooking a vast expanse. 1

## ***II. PRESENTATION OF THE TINDOF COMMUNE***

### **1. Geographical Situation and Regional Context:**

Tindouf was promoted to the status of a provincial capital following the administrative division of 1984. It comprises two municipalities: Oum El Assel and Tindouf.

The municipality of Tindouf covers an area of 70,008.84 km<sup>2</sup>. It is located in the southern part of the Tindouf Province. This province was established as a result of the 1984 administrative division and includes only two municipalities: Tindouf and Oum El-Assel. The city of Tindouf serves as the capital of the municipality, district (Daira), and province of the same name.

The municipality of Tindouf is bounded as follows:

- To the north and northeast by the municipality of Oum El-Assel,
- To the northwest by Morocco,
- To the southeast by the Adrar Province,
- To the south and southwest by the SADR (Sahrawi Arab Democratic Republic) and Mauritania.<sup>1</sup>

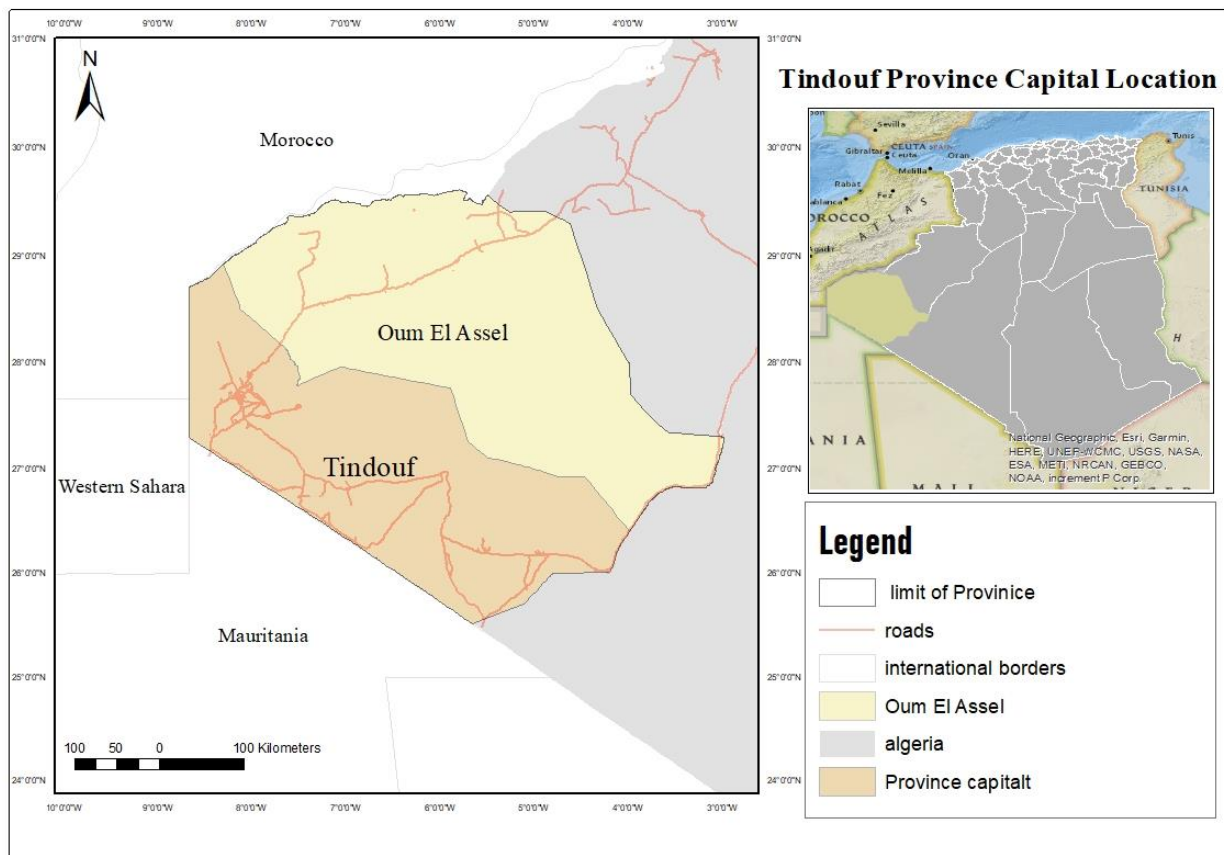


Figure 3 Tindouf Province Capital Location. Created by a student.

## 2. LANDSCAPE DOMINATED BY HAMADAS:

The communal territory is characterized by various desert reliefs, particularly the hamadas. Indeed, analysis of the 1/200,000 topographic maps shows tabular relief

<sup>1</sup> Cabinet d'Architecture et d'Urbanisme BOUIDA ABDELFE TAH. (2018). *Révision du PDAU de la commune de Tindouf – Phase III*. Department of Urban Planning, Architecture and Construction of the Wilaya of Tindouf.

with modest altitudes of between 300 and 500 meters, rarely exceeding 500 meters.

The elements that make up the landscape are:

- The Hamadas, vast expanses of rocky slabs. The hamadas occupy almost the entire municipal territory, and are part of the vast Hamada du Draâ depression.

Locally, we have the Hamada of Tindouf, the Hamada of Douakel and the Hamada of Aroueida.

Relative to the hamadas, and in much more modest proportions, we have :

- *The Yetti-Eglab massifs*: located to the south-east of the commune. In general, these are eroded terrains, peneplains where the relief reveals intrusions of diorite and rhydite. The Yetti and Eglab massifs bear witness to remnants of ancient relief.
- *The Ouarkziz mountains*: located to the north-west, on the municipal boundary and the Algerian-Moroccan border, these mountains are marked by a crater located in the commune of Oum El-Assel.
- *The Erg Iguidi dunes*: a sandy area to the south of the municipality. The Erg is a massif of dunes of varying shape and extent. Erg Iguidi covers a large part of Yetti-Eglab.
- *Sebkhas*: The commune of Tindouf has several sebkhas, which are generally depressions in the Hamadas, the most important of which is the Tindouf sebkha, relatively close to the town of Tindouf.<sup>1</sup>

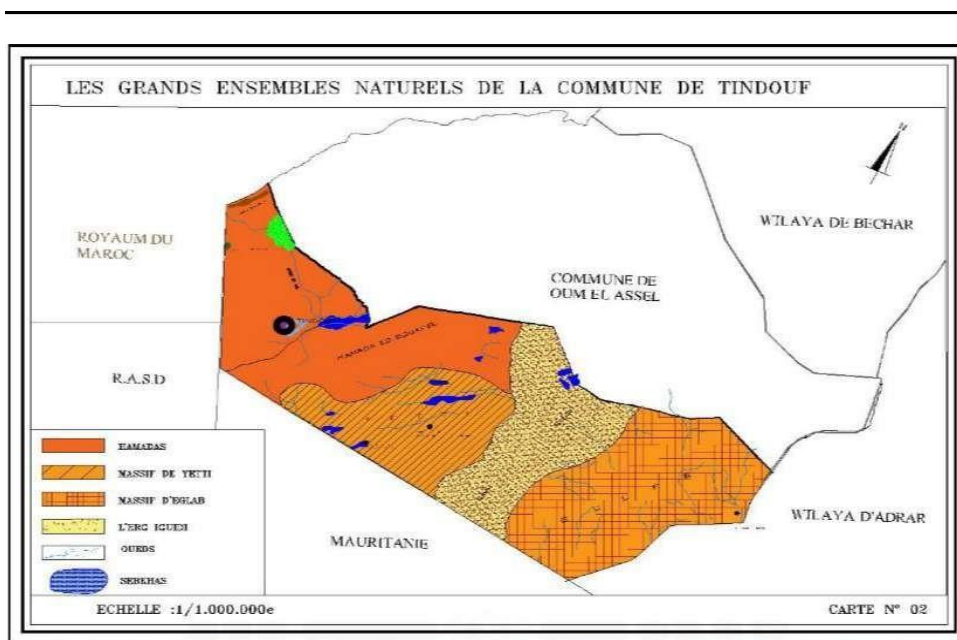


Figure 4 Natural Features of the Commune of Tindouf

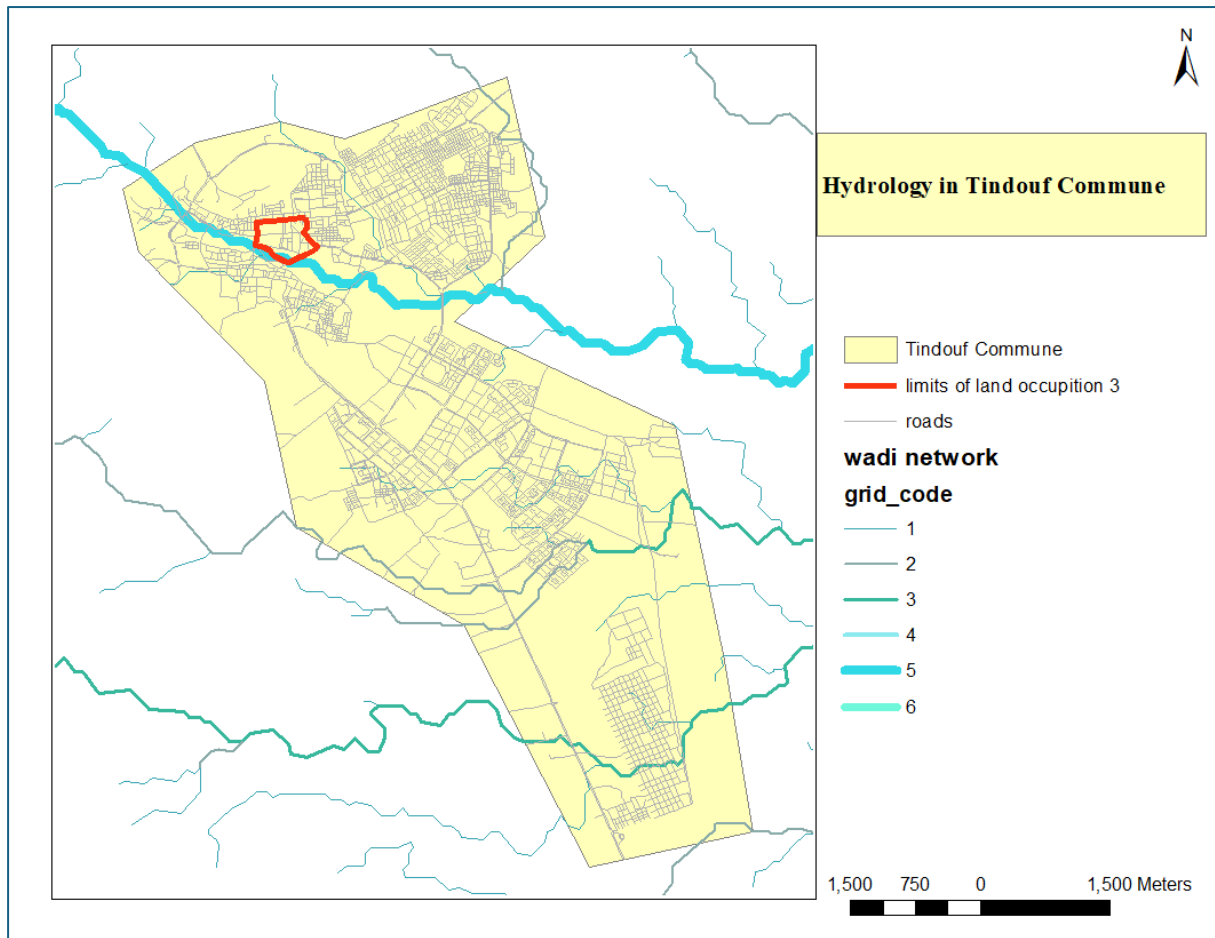
### 3. HYDROGRAPHY: A TERRITORY CRISS-CROSSED BY DRY WADIS

The commune, like the rest of the Tindouf wilaya, is criss-crossed by dry wadis, which fill up "for a few days, or even a few hours only" during the rare rains, or rather showers. The most important of these is Oued El Ma, the main collector to the north Tindouf, with its Argan forest. The other wadis are:<sup>1</sup>

- Oued Houiar to the north,
- Oued Nouamer, to the south,
- Oued Feli, to the south,
- Oued Hamra to the south.

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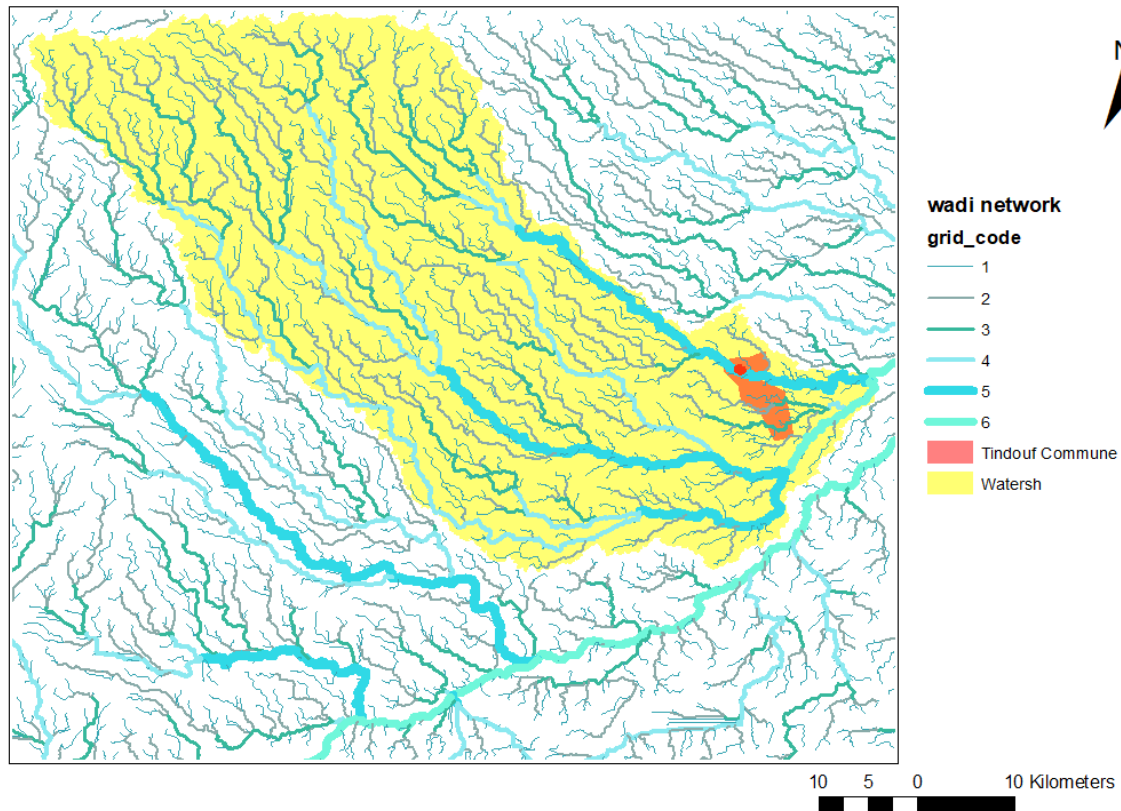
<sup>1</sup> 1 (page 9)



*Figure 5 hydrology wadi network*

The site is part of a large watershed with a total surface area of approximately **208,525 hectares (2,085.25 km<sup>2</sup>)**. This large size allows for the accumulation of rainwater from a wide zone, especially during heavy rainfall. The watershed converges toward the Sebkhha of Tindouf, a natural low basin that functions as a final collector of runoff water.

### Hydrological Basin of Wadis in Tindouf Commune



*Figure 6 hydrological basin od wadis in Tindouf commune*

#### **4. GEOMORPHOLOGY:**

The geomorphology of the Tindouf commune is essentially sedimentary. In the western part, the Hamada de Draa is formed of ancient sedimentary rocks to the north and slightly deformed sedimentary rocks to the south, while the Hamada de Tindouf is formed of hydroeolian sedimentary rocks.

the eastern part: the Yetti massif is made up of metamorphic rocks, while Erg Iguidi is made up of living dunes. The Eglab massif is made up of various sedimentary and metamorphic rocks.<sup>1</sup>

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<sup>1</sup> 1 (page 10)

## 5. GEOLOGY AND GEOTECHNICS:

Structurally, to the north, the municipality's territory is bounded by the Anti-Atlas range, with its tight, accentuated structures. The central part is part of a vast area of buried Precambrian basement; the Precambrian terrains outcrop in the Yetti-Eglab massif. The Paleozoic terrain, which dips between 1 and 2°, fills this depression along a west-east axis.

Stratigraphically, the following formations can be distinguished:

- The Precambrian rocks that make up the crystalline basement are metamorphosed and granitized.
  
- The Paleozoic terranes include the Cambro-Ordovician: the Rhezziane sandstone series consists of three formations 40m to 70m thick: Oued Mténag sandstone, Djebilet quartzite and Aouinet sandstone; the Silurian overlies the Rhezziane formation, with the dominant lithology being sandstone schist, and the Devonian with its two layers. The Middle Devonian has two formations: the Oued Talha formation, which is predominantly sandstone, and the Sebbat formation, which is a combination of limestone and marl-limestone, and the Upper Devonian, which is also made up of two main groups: the schistose-sandstone group and the clay group. The other layer, the Carboniferous, is characterized by the Kerb Es-slougia formation (Tournaisian): sandstone-limestone, in which the carbonate phase rapidly assumes importance due to the multiplicity of limestone banks. The Es-safiat formation comprises alternating limestone-sandstone and clay-marl. The Ain El Barka formation begins with sandy marl and soft sandstone, followed by limestone.
  
- Tertiary and Quaternary overburden: in places, this overlies the Paleozoic series and the crystalline basement.

Tertiary formations occur in thin veneers called hamadas, which locally cover both Precambrian and Paleozoic formations. The hamada formations appear as horizontal plateaus. Their thickness varies from a few metres to several dozen metres. Their composition is essentially sandstone and limestone.

The Quaternary formations have several aspects

- Lacustrine deposits: sebkhas deposits
- Fluvial alluvium: wadi beds
- Dunes: ancient and living dunes

Tectonically, there are three categories of faults and fractures:

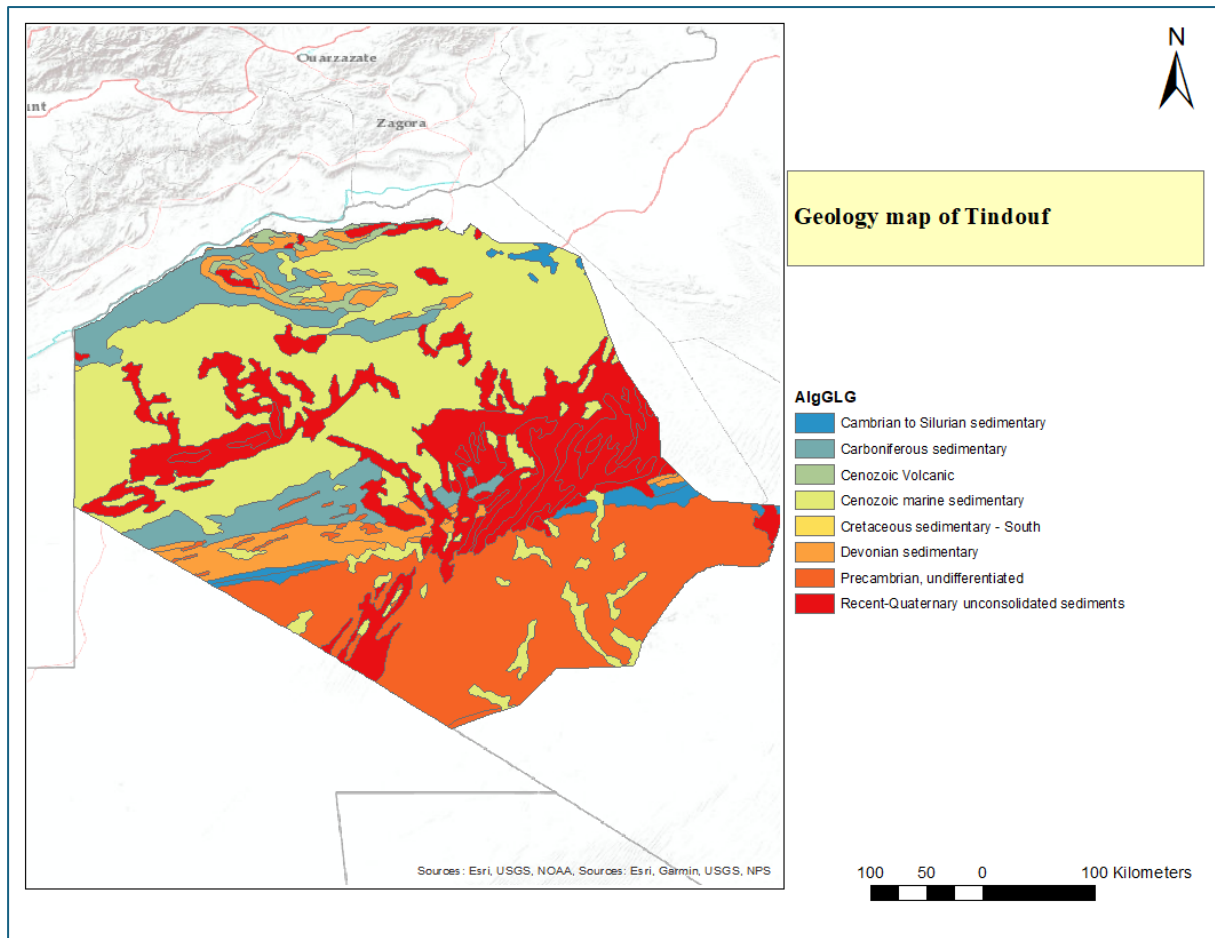
- Continental fractures, linked to the general tectonics of the basement.
- regional fractures, caused by subsidence of the continental shelf
- local fractures, which affect the sedimentary cover.

Relief, geomorphology and geology do not constitute constraints to urban development, especially in low-seismic zones. However, when combined with climate, they can present real obstacles.

According to local surveys, the subsoil is marked in places by the presence of gypsum (sulfate), which is aggressive to concrete, hence the use of special cement (C.R.S or H.T.S). The sand used construction is of average quality, which means that its weakness in strength needs to be compensated for. Hard soils (2 to 2.5 bars) and normal soils (1.5 to 02.00 bars) are the most common in the commune. There are also gypsum zones near the sebkha.<sup>1</sup>

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<sup>1</sup> 1 (page11)



*Figure 7 geology map*

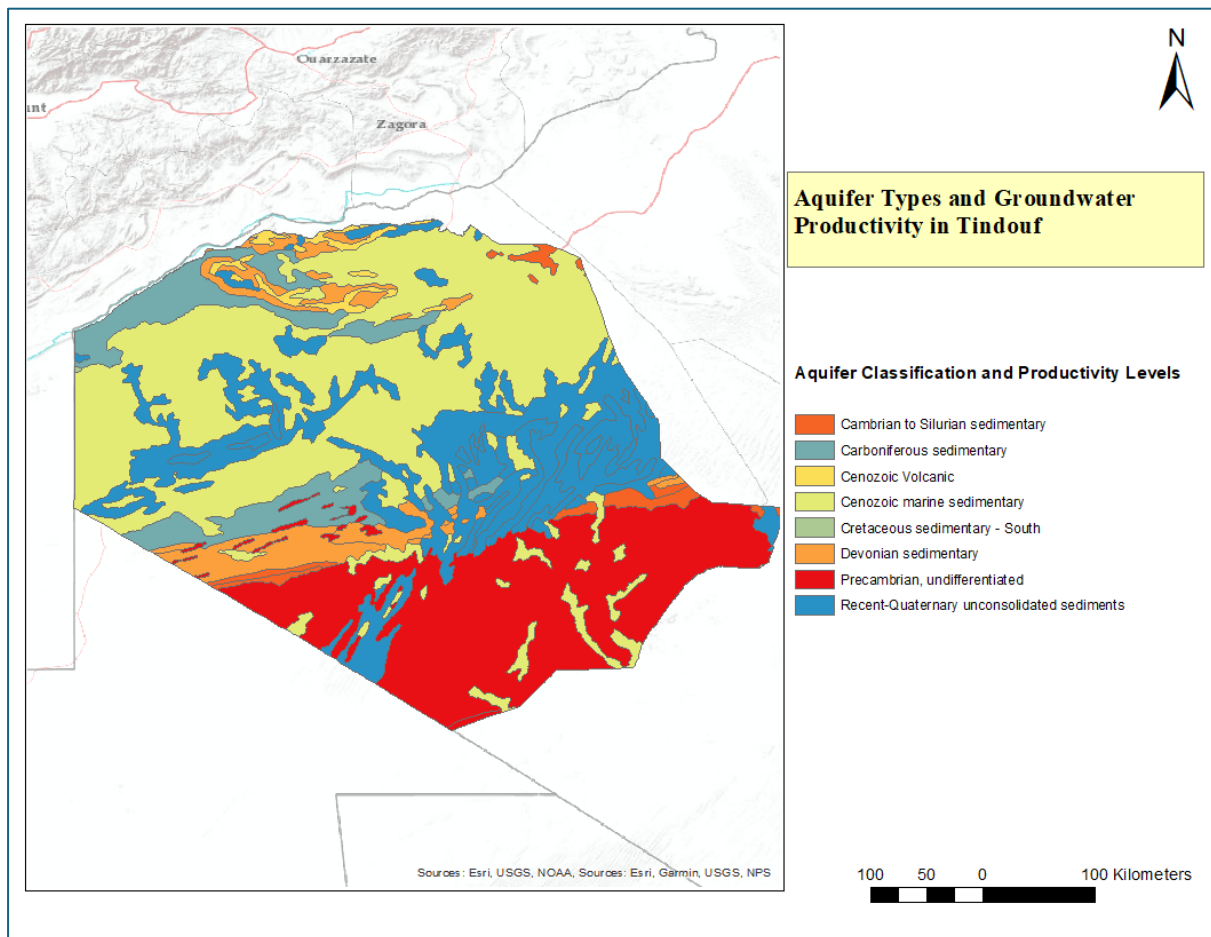
## 6. AQUIFER SYSTEMS IN TINDOUF

The aquifer structure of Tindouf is characterized by limited groundwater productivity and weak water infiltration. This condition increases the vulnerability of urban areas located near Wadis, where surface runoff is favored over underground water absorption. The main aquifer units present in the region are summarized in Table 1

Aquifer Unit	Flow Rate (l/s)	Water Quality	Importance

<b>Upper Visean Unit</b>	-	Good (main drinking source)	Supplies Hassi Abdellah wellfield
<b>Hamadian Unit</b>	2 to 15	High sulfate and chloride content	Limited use due to poor water quality
<b>Devonian Sandstone Unit</b>	2 to 12	Good (residuals 0.6 to 1.50 g/l)	Suitable for various uses
<b>Ordovician Gambro Sandstone Unit</b>	Very low	Not specified	Marginal importance (south of Wilaya)

*Table 1 Characteristics of Main Aquifer Units in Tindouf*



*Figure 8 AQUIFER TYPES IN TINDOUF*

The spatial distribution of aquifer types and groundwater productivity levels across Algeria, including the Wilaya of Tindouf, is shown in Figure 7.

## **7. CLIMATOLOGY**

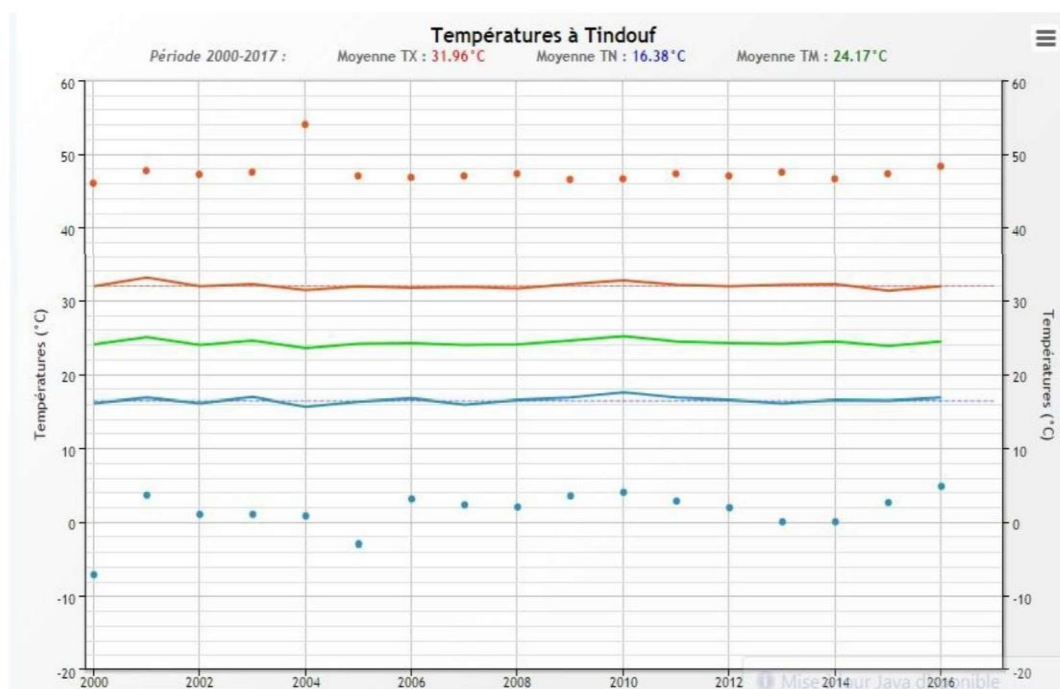
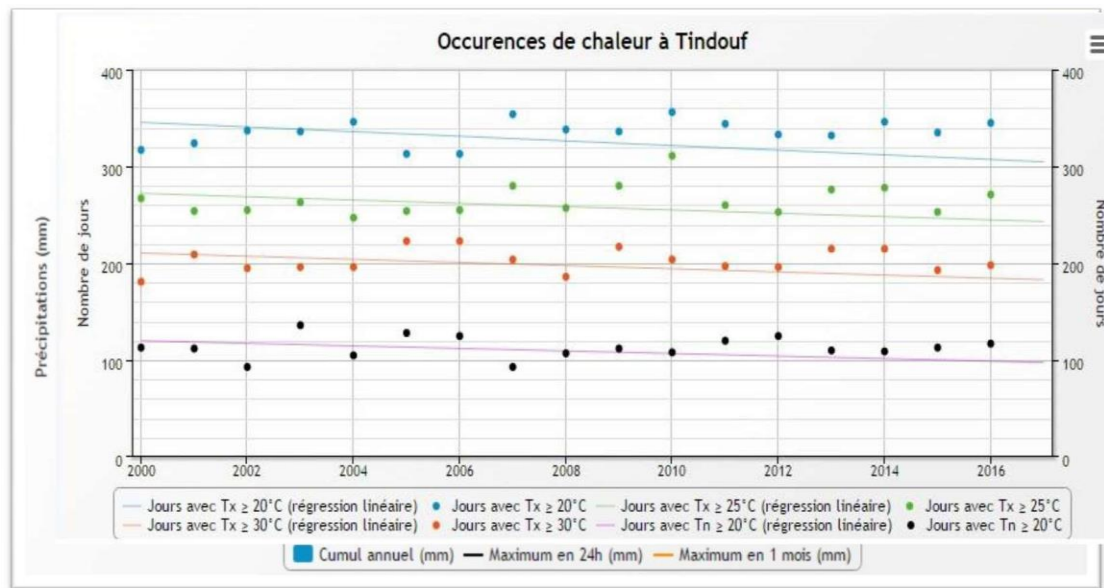
Due to its geographical position, the climate of the commune of Tindouf is of the Saharan type, characterized by dry, hot summers and arid, cold winters, as well as by the non-existence of intermediate periods, with a direct transition from winter to summer.

The lowest temperatures in the region are in January, and the highest in July. However, the commune benefits from a slight marine influence due to its relative proximity to the Atlantic Ocean. This influence translates into a sea breeze that softens the climate.<sup>1</sup>

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<sup>1</sup> 1 (page 13)

Figure 9 the climate of the commune of Tindouf source: *Révision du PDAU de la commune de Tindouf – Phase III.*



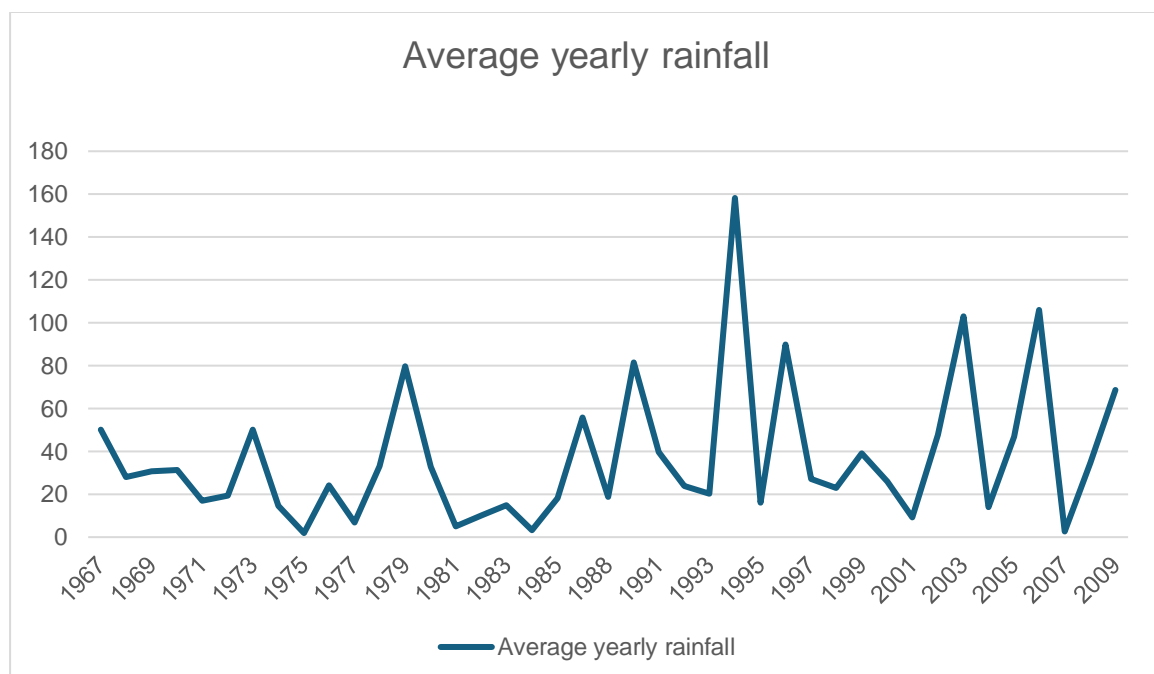
## 8. Rainfall :

The study area is characterized by irregular and generally very low precipitation, typical of arid climates. Historical data from various observation periods reveal a clear fluctuation in rainfall levels, with an overall trend of decline.

- From **1975 to 1984**, the **average annual rainfall** was approximately **21 mm**.
- Between **1990 and 2000**, it increased slightly to **45 mm**, spread over an average of **14 rainy days per year**.
- When compared to older data from the **1913–1938** period (Seltzer), where the average rainfall reached **88 mm** over **19 rainy days**, a significant long-term decrease is evident.

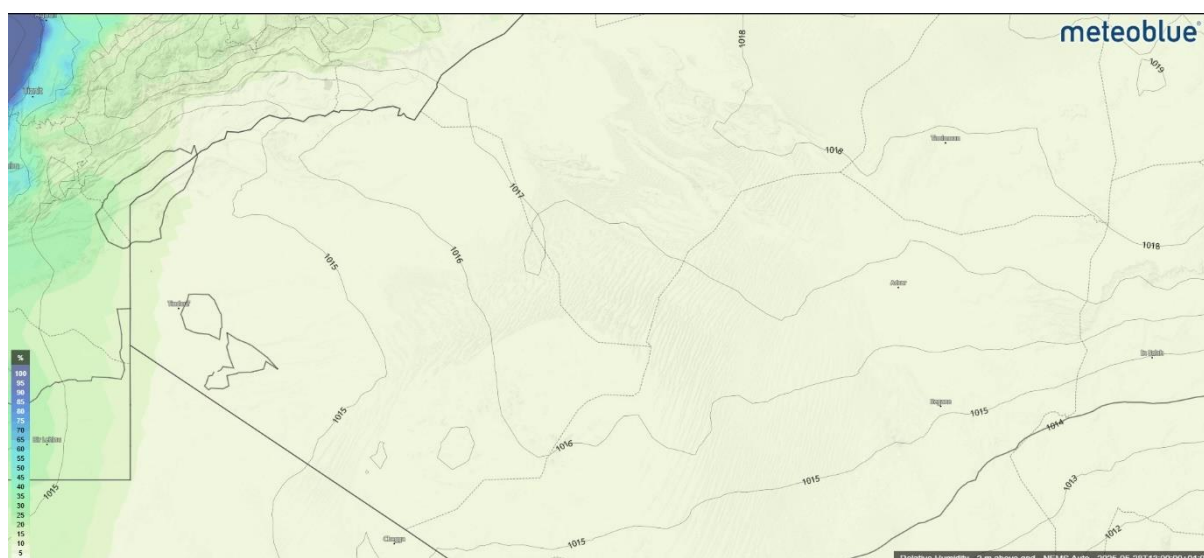
Rainfall measurement coverage in southern Algeria is very sparse. According to Dubief, the shortest distance between two meteorological stations in the region can be around **300 km**. For this study, there is no climate station located directly within the watershed. Therefore, the **Tindouf** station, the closest one, is used as the main reference.

Rainfall data was collected from the **National Office of Meteorology (O.N.M)** and consists of **monthly and annual totals** from **1967 to 2009**.



## 9. Relative humidity:

The average relative humidity recorded throughout the year is 37.6%, which is a particularly low level, although there are, of course, seasonal and daily variations.



## 10.SOCIO-DEMOGRAPHIC ANALYSIS:

### 10.1. Population distribution by dispersion according to RGPH 2008:

*Table 2 Population distribution 2008 I*

<b>Dispersion</b>	<b>2008 population</b>	<b>Concentration rate</b>
A.C.L	41785	90 %
Secondary clusters	0	-
Sparse area	331	0,7 %
nomads	4264	9,3%
Municipality	46380	100%

Source: communal summary table (TRC), RGPH 2008

The concentration rate in the chef-lieu is 90% of the commune's total population, and the same applies to the entire wilaya, with 87.50% in the combined chefs-lieux ACL Tindouf and ACL Oum El-Assel, and over 95% in Tindouf. Aside from the town of Tindouf, which practically merges with the commune, or even the wilaya, in terms of population distribution across the communal and wilaya

territory, we have a sparse communal population of Tindouf that represents just 0.7%. As for the nomadic population, it represents 9.3% of the communal population in 2008. This situation is all the more

Contrasting given the vastness of the territory of the commune and the wilaya of Tindouf.<sup>1</sup>

## 10.2. changes in the resident population:

POPULATION BREAKDOWN BY DISPERSION

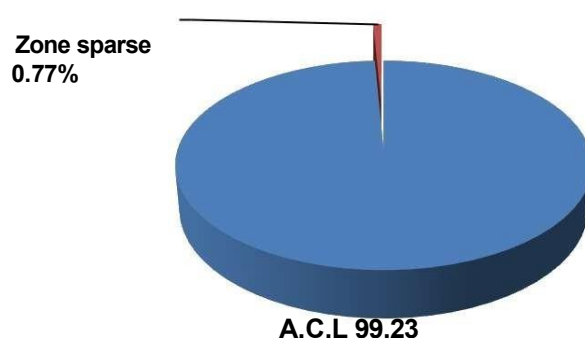


Table 3 changes in the resident population

dispersion	Pop. 1977	Pop. 1987	Pop. 1998	Pop. 2008	T.A.G 77/87	T.A.G 87/98	T.A.G 98/2008
LCD	6263	13084	22677	45610	7,56	5,00	7,38
Agg. second	-	-	-	-	-	-	-
Sparse area	453	248	297	356	-5,79	1,61	1,86
nomads	701	396	1147	4264	-5,50	9,89	14,31
commune	7417	13728	24121	50230	6,28	5,13	7,76

Source: O.N.S - DPSB - RGPH 1977-1987-1998-2008

<sup>1</sup> (page 15)

The overall rate of growth in the communes main town fell from 7.56% between 1977 and 1987, to 5% between 1987 and 1998, and rose again to 7.38 between 1998 and 2008. ACL has thus recorded a very high rate of growth over the last decade. The commune's rate, for the same periods, fell from 6.28% to 5.13%, then rose considerably to 7.76%. However, the rates recorded at municipal level should be treated with great caution, given the significant fluctuations in the sparse and nomadic population.

The latter rose from -5.5% between 1977 and 1987 to +9.89% between 1987 and 1998, then to 14.31% between

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>Births</b>	1659	1718	1265	1027	1362	1610	2923	4796	1972	2417	1902
<b>Deaths</b>	227	231	233	187	211	232	319	373	351	340	277
<b>Growth absolute</b>	1432	1487	1032	840	1151	1378	2604	4423	1621	2077	1625

1998 and 1999.

1998 and 2008.<sup>1</sup>

### **10.3. Average natural growth:**

If we take into account the data in the previous table, we have an average of 22651 births and 2981 deaths over the last decade, an absolute natural increase 1788 individuals per year.

Now, based on available data, let's calculate the rate of natural increase between 2006 and 2015. The natural balance in 2006 is 1487 for an estimated population of 40700 (2006 PDAU); the natural balance in 2015 is 1625 for a population of 71478 (statistical yearbook of the wilaya of Tindouf for the year 2016).

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<sup>1</sup> (page 16)

So TAN (2006) = [(N/p)\*1000]-[(M/p)\*1000]= 3.65% and

TAN (2015) = [(N/p)\*1000]-[(M/p)\*1000] = 2.27%. That's an average of 2.96% over the past decade.<sup>1</sup> **Table 4 : Average natural growth**

Source: APC DE TINDOUF

### High net migration:

In the absence of data on emigration from and immigration to Tindouf, and taking into account the 2008 overall growth rate of the LCA and the sparse area

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>Births</b>	1659	1718	1265	1027	1362	1610	2923	4796	1972	2417	1902
<b>Deaths</b>	227	231	233	187	211	232	319	373	351	340	277
<b>Growth absolute</b>	1432	1487	1032	840	1151	1378	2604	4423	1621	2077	1625

combined, which is around 6.37%, and the natural growth rate, which is 2.96%, net migration would be around 3.41%, which represents more than half of overall population growth, and is very high.

### 10.4. population, housing and households:

Source: communal summary table (TRC), RGPH 2008

dispersion	population 2008	Total number of units	Number of inhabited dwellings	Number of households	Household/og ratio
Municipality	45966	9567	8681	7929	1.09

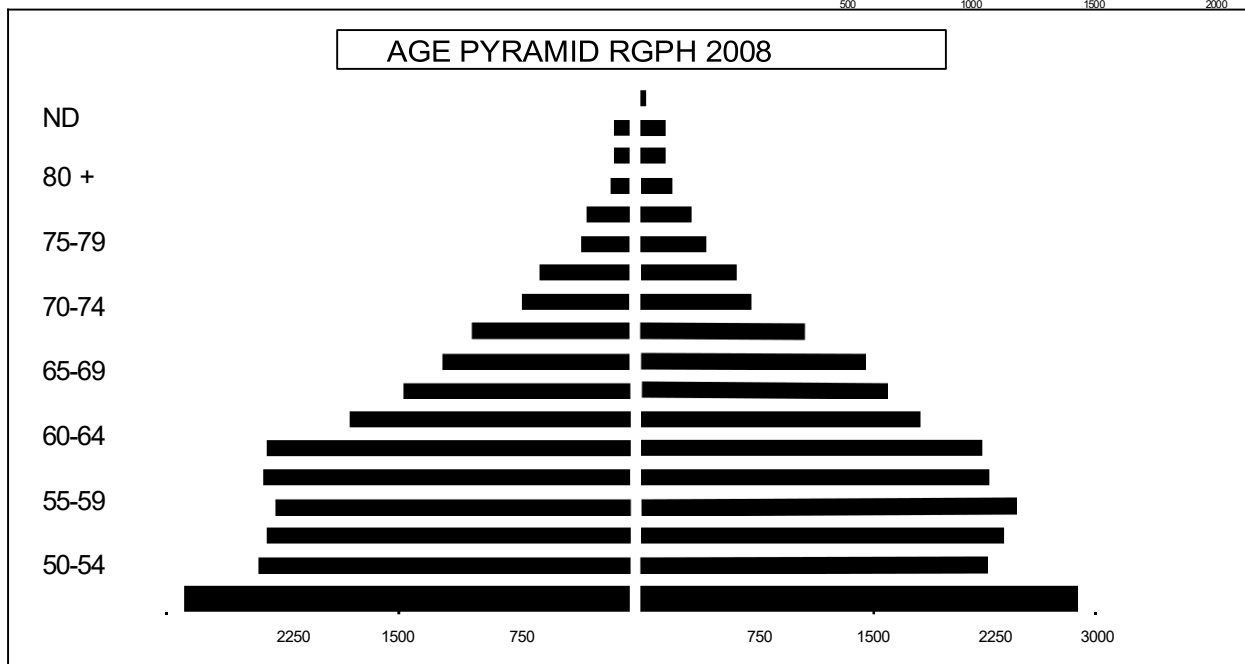
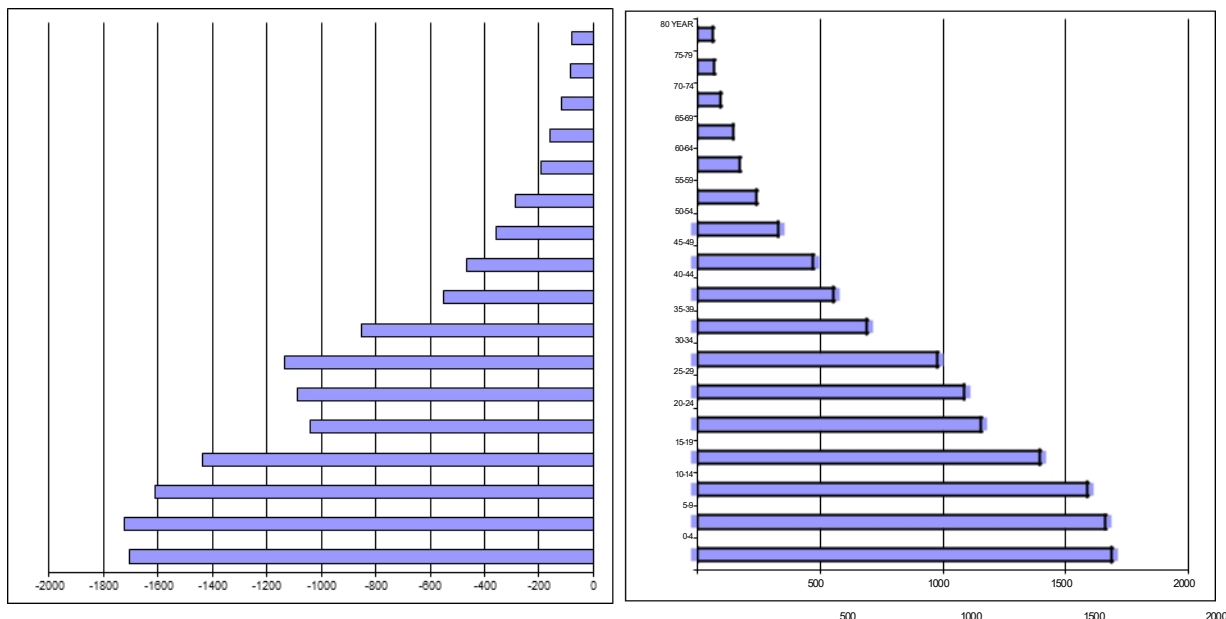
The number of households in relation to the number of inhabited dwellings shows that there is almost one household per dwelling in the commune. This probably

<sup>1</sup> (page 17)

implies a trend towards the "split" family, with the family unit reduced to a couple with children.

Age Group	MALE		FEMALE		MASC+ FEM	
	TOTAL	%	TOTAL	%	TOTAL	%
00 to 04	2887	6,28%	2836	6,17%	5723	12,45%
05 to 09	2292	4,99%	2441	5,31%	4733	10,30%
10 to 14	2392	5,20%	2376	5,17%	4768	10,37%
15 to 19	2475	5,38%	2335	5,08%	4810	10,46%
20 to 24	2303	5,01%	2422	5,27%	4725	10,28%
25 to 29	2246	4,89%	2397	5,21%	4643	10,10%
30 to 34	1843	4,01%	1846	4,02%	3689	8,02%
35 to 39	1621	3,53%	1488	3,24%	3109	6,76%
40 to 44	1480	3,22%	1228	2,67%	2708	5,89%
45 to 49	1075	2,34%	1026	2,23%	2101	4,57%
50 to 54	743	1,62%	699	1,52%	1442	3,14%
55 to 59	637	1,39%	596	1,30%	1233	2,68%
60 to 64	437	0,95%	325	0,71%	762	1,66%
65 to 69	333	0,72%	280	0,61%	613	1,33%
70 to 74	211	0,46%	133	0,29%	344	0,75%
75 to 79	156	0,34%	109	0,24%	265	0,58%
80 +	161	0,35%	99	0,22%	260	0,57%
No decl	41	0,09%	0	0,00%	41	0,09%

**Age pyramid RGPH 1998 (PDAU 2006) .**



An analysis of the age structure shows that the population of the Tindouf commune is extremely young. Some 64% of the population is under 30, and 44% under 20.

This implies enormous challenges in the employment and education sectors in particular. However, it is worth noting that the morphology of the pyramid

between the last two censuses (see graphs below). Indeed, the 2008 RGPH pyramid is irregular, with a narrower base when compared to the 1998 RGPH pyramid. This implies a relative ageing of the population in the last decade compared with previous ones.

### **10.5. Housing situation: a very high rate of change**

The table below shows that the rate of change in the housing stock averaged 87% between 1998 and 2015. This is an indicator of the speed of urban growth, this shows that Tindouf's growth rate is very high. This rate is currently 66% and will be even higher with the OPGI programs underway, which amount to 1,428 housing units, and the progress of housing estates and rural housing which are proliferating in the southern part of the town.

**Table 5 the rate of change in the housing:**

Year	dispersion	Total number of units	Number of additional housing	Gross evolution rate
1987	commune	2469	-	105%
1998	commune	5067	2596	105%
2008	commune	9567	4500	89%
2015	commun e	15841	6274	66%

Source REVISION OF THE PDAU OF THE COMMUNE OF TINDOUF - BOUIDA ABDEL FETAH" architecture and urban planning firm

### **10.6. TOL and TOP situation**

Analysis of occupancy rates per dwelling and per room, which are social indicators, provides us with information on living conditions within the dwelling. Both rates show acceptable values, with the situation, according to the 1987 to 2008 censuses, being as follows:

*Table 6 TOL and TOP situation*

Year	dispersion	Population	Total number of units	Number of inhabited dwellings	TOL gross	TOL net
1987	commune	13728	2469	-	5,56	-
1998	commune	24121	5067	-	4,76	-
2008	commune	45966	9567	8681	4,80	5,30
2015	commune	71478	15841	15080	4,51	4,74

Source: O.N.S - RGPH(s), DPSB 2016

The "gross" TOL, i.e. the ratio to the total number of dwellings, has averaged around 5 people/house since the 1987 RGPH. But this rate is slightly higher if we refer to the number of inhabited dwellings as the "net rate". We note, however, that in both cases, the TOL is tending to fall and is close to average of 4.50 people per dwelling. This reduction in TOL is certainly due to two key factors:

- A rich and diversified housing program: social housing, company housing, self-build, rural housing,.....etc.
- The rise in age of marriage, and therefore the evolution of the marital situation general, has had a major impact on the quality of life.

As for the occupancy rate per room, and again according to data from "DPSB Statistical Yearbook 2016", it is 1.5 people per room, very satisfactory as the recognized pathological threshold is 2.5 people per room.

#### **10.7. level facilities in the town of Tindouf :**

To assess the level of amenities in the commune of Tindouf, we begin with an inventory of all the facilities and services available in the main town, which is of course the only town in the commune.

Next, we'll make a comparison, in terms of equipment, between the 2006 PDAU data and the current state of affairs (see following table). Finally, we'll make a

comparison with current standards and the GEM (ministerial equipment grid).

## 11. Comparative table of equipment between 2006 and 2016

Table 7 Comparative table of equipment between 2006 and 2016

Nature	City facilities of Tindouf PDAU 2006	no.	City facilities of Tindouf PDAU 2016	no.
Sanitary equipment	Polyclinic,	01	<input type="checkbox"/> Polyclinic,	05
	<input type="checkbox"/> Treatment rooms,	05	<input type="checkbox"/> Treatment rooms,	07
	<input type="checkbox"/> A pharmacy	13	<input type="checkbox"/> A pharmacy	14
School equipme nt	<input type="checkbox"/> elementary school (1st and 2nd cycles),	16	<input type="checkbox"/> elementary school (1st and 2nd cycles),	24
	<input type="checkbox"/> A CEM (3rd cycle),	06	<input type="checkbox"/> A CEM (3rd cycle),	09
	<input type="checkbox"/> high schools	02	<input type="checkbox"/> high schools	03
Training prof.	<input type="checkbox"/> A training center professional.	01	two training centers professional.	02
Equipts de sports and leisure	<input type="checkbox"/> Municipal stadium	01	<input type="checkbox"/> Municipal stadium	01
	<input type="checkbox"/> Playgrounds	02	<input type="checkbox"/> Playgrounds	04
	<input type="checkbox"/> Combined land	07	<input type="checkbox"/> Combined land	46
	<input type="checkbox"/> Sports halls	01	<input type="checkbox"/> Sports halls	02
	<input type="checkbox"/> C.S.P	02	<input type="checkbox"/> C.S.P	02
	<input type="checkbox"/> Indoor pools	01	<input type="checkbox"/> Indoor pools	01
	<input type="checkbox"/> Swimming pools	00	<input type="checkbox"/> Swimming pools	02
Equipments Cultural	<input type="checkbox"/> Cultural Center	01	<input type="checkbox"/> Cultural Center	01
	<input type="checkbox"/> Movie theaters	00	<input type="checkbox"/> Movie theaters	01
	<input type="checkbox"/> Reading room	00	<input type="checkbox"/> Reading room	01
	<input type="checkbox"/> Library	00	<input type="checkbox"/> Library	01
	<input type="checkbox"/> Auberge	00	<input type="checkbox"/> Auberge	01
	<input type="checkbox"/> Youth centre	00	<input type="checkbox"/> Youth centre	02
	<input type="checkbox"/> CIAJ	00	<input type="checkbox"/> CIAJ	01

Source Révision du PDAU de la commune de Tindouf – Phase III.

The table above (column 4) provides an inventory of all the local and ancillary facilities that currently exist and are necessary for the operation of the town of Tindouf. This panoply of facilities is reinforced by other types of equipment that reinforce the town's role and status as a commune, daïra and wilaya capital.

**Administrative and military facilities:** APC headquarters, Daïra headquarters, wilaya headquarters, wilaya directorates for all sectors, bank and insurance headquarters, post offices, tax offices, .... etc. Other head offices of various organizations, urban security, civil protection, gendarmerie, etc.

**Religious facilities:** Mosques, Islamic Cultural Centers, Zaouiates,

**Commercial and social facilities:** the town, and therefore the commune, a wide range of retail and wholesale outlets, as well as a variety of services that have been proliferating in recent years.

**General facilities:** cemeteries, slaughterhouses, Sonelgaz power stations, telephone centers, municipal parks, bus stations,

**Major regional and international facilities:** a weekly market, a 210-bed hospital, a university center, and an international airport.

In terms of the evolution of the level of equipment, the table clearly shows, through a comparison of 2006 and 2015 data, a clear improvement in both quantity and quality.

As for standards, the analysis shows :

In terms of school support structures, the level of equipment is highly satisfactory. In fact, the previous analysis (chapter on the school population) shows that the infrastructure and rates recorded largely meet the sector's needs

As far as health facilities are concerned, they remain largely adequate with very satisfactory

coverage rate:

the 210-bed hospital, which is currently more than sufficient, offering 02 beds per 724 inhabitants, while the norm is 02 per 1000 inhabitants,

Five polyclinics in the ACL, meaning 01 polyclinic per 1,296 inhabitants, whereas the norm is 01 polyclinic per 30,000 inhabitants.

Fourteen pharmacies, giving a total of 01 pharmacy/5498 inhabitants. 01 pharmacy/6,000 inhabitants.

- Twelve wards with 01 ward/5957 inhabitants, it should serve a population of just 2,000. However, this deficit is largely made up by existing polyclinics and health centers.

We have satisfactory staffing levels, with: One doctor for 694 inhabitants, while the standard is 01/1000 inhabitants; one dentist for 4,467 inhabitants, while the standard is 01 dentist/5,000 inhabitants, and one paramedic for 228 inhabitants, while the standard is 01 paramedic/200 inhabitants.

As far as sports facilities are concerned, they more than meet the needs of today's population, even if there is a slight shortfall in terms of sports halls and swimming pools if we take into account the ministerial equipment grid, which stipulates these types of facilities for every grouping of units of 5,000 dwellings or more. However, we currently have two sports halls and two swimming pools for around 16,000 housing units.

In terms of cultural facilities, there's a shortfall here too. While the number of youth centers, reading rooms and libraries is satisfactory, the same cannot be said for cultural centers and cinemas, as the town is currently served by only one of each type of facility, instead of at least two, according to the ministerial equipment grid.<sup>1</sup> *Source Révision du PDAU de la commune de Tindouf – Phase III*

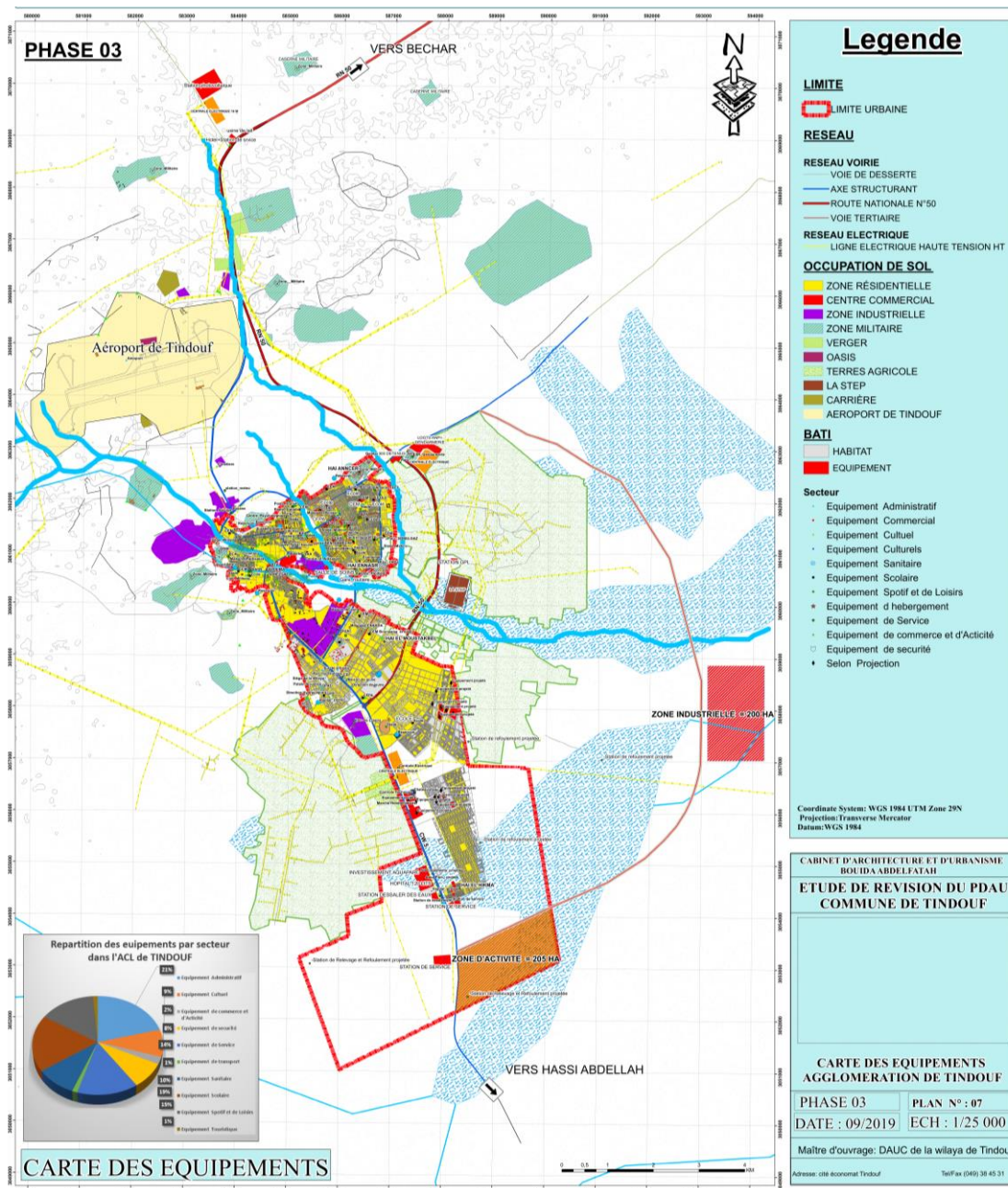


Figure 10 Map of facilities

## II. THE COMMUNE'S BASIC INFRASTRUCTURE:

### 1. ROAD INFRASTRUCTURES:

In terms of road infrastructure, the commune of Tindouf is crossed by Route Nationale 50 over a distance of 728 km, half of which is unpaved. This road connects the wilaya of Tindouf to the north, south and center of the country. This

national road will be reinforced by the regional road currently under construction, which will link Tindouf to Adrar in the south, in the Chénachene area.

Within the commune, a single wilaya road, the CW 01, 61 km long from the RN 50, leads north of the town to Adim El-Talh. On the other hand, the commune has a large number of communal roads throughout its territory, as follows:

The 3 km-long CC linking the RN50 to the airport, to the north of the town,

The CC linking the RN 50 to Gara Djebilet, 17 km to the south,

The CC marking the 10 km eastern bypass of the city,

The 12.6 km-long CC linking the town to the Sebkhia river to the east

The 2 km-long CC linking the RN 50 to the public rubbish dump, to the west of the town,

CC linking RN 50 to Grair El-Hath, 10 km north of Tindouf ACL

The CC linking the RN 50 to Hassi LA9, 1.36 km long,

The CC linking the RN 50 to Hassi Abdallah, 35.5 km south of Tindouf ACL

All CW and CC roads are paved. In addition, all paved roads are subject from time to time to modernization, repair, etc. operations.

Other unclassified roads include border roads and tracks. The former link Tindouf to Morocco and Mauritania over 120 km and 73 km to the west, and are both paved. As for the latter - the border tracks - they criss-cross the entire communal territory over 931 km, 153 km of which are paved.

### **URBAN ROADS:**

The urban road network in the Tindouf conurbation is mainly structured around the primary route, the RN 50, followed by the first siding linking the ZHUN to the Hassi Ammar business park, and the second siding to the east of the town.

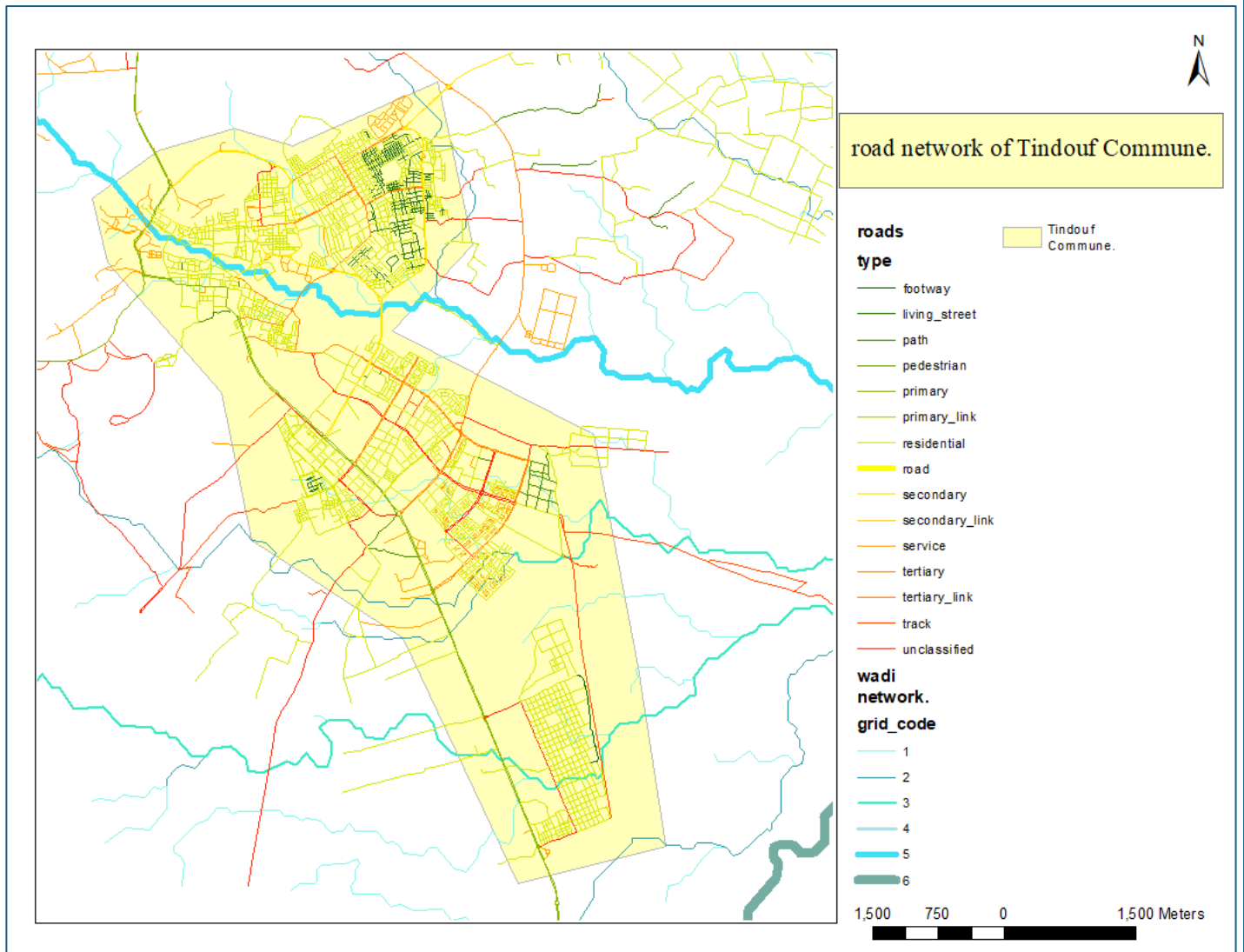


Figure 11 road network of tindouf

In fact, all the secondary roads serving the neighborhoods are connected to the previous roads by a multitude of nodes. With the exception of the new extension to the south, the entire public spaces (plazas, green spaces, sidewalks, street furniture, parking spaces, , etc.).

#### ELECTRICAL AND ENERGY INFRASTRUCTURES :

The municipality and main town of Tindouf are served by two 93.2 MW power plants, with an electricity connection rate of 98%, supplying 14,456 households and a distribution network length of over 1,000 km.

As for gas, the commune of Tindouf, the capital of Tindouf, is served by an LPG station located to the east of the town. The rate of connection to the gas network

is 54%, supplying 7,803 households, with a distribution network length of around 150 km. Nevertheless, around 50% of households still rely on butane gas supplies by land transport.

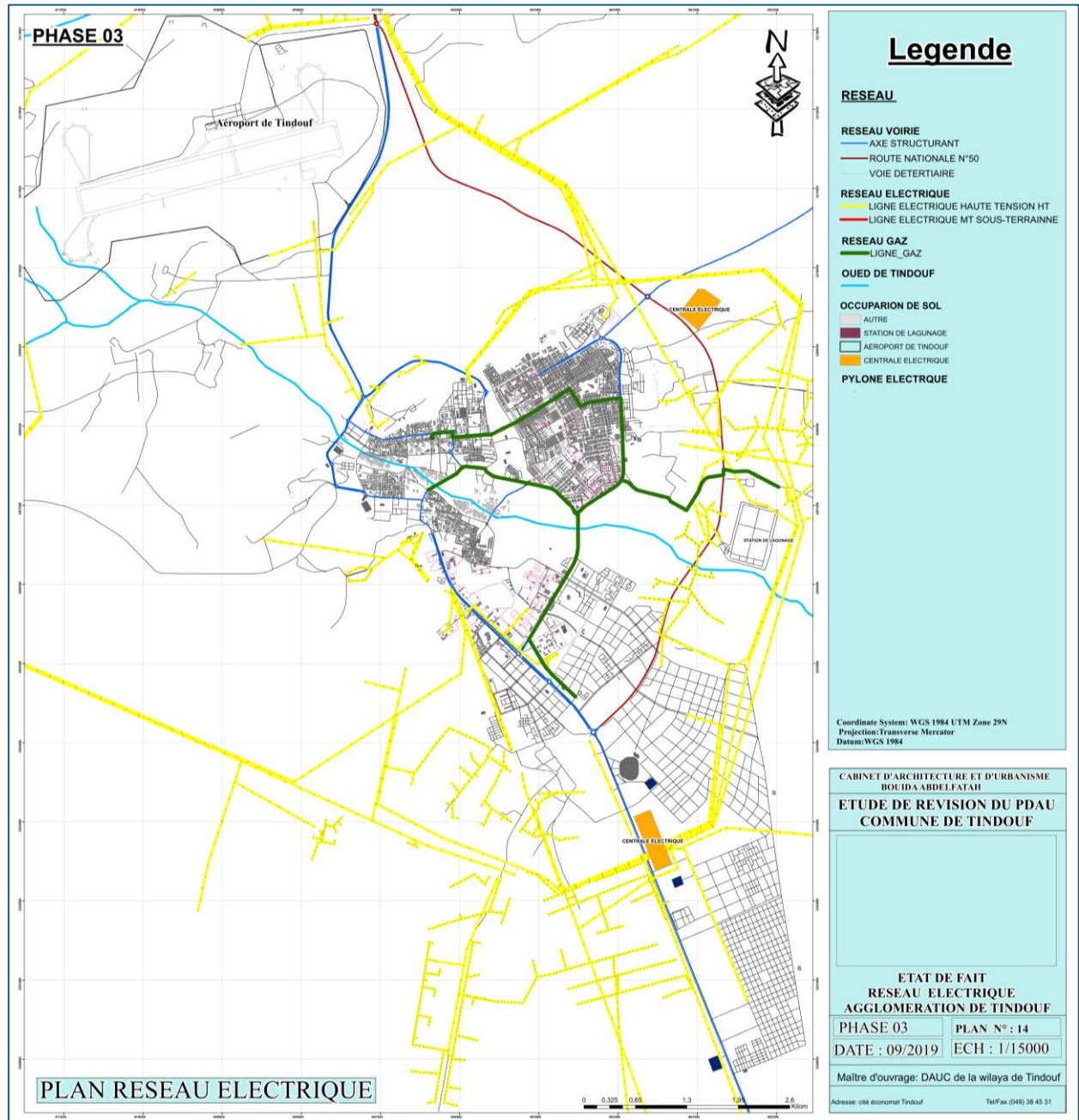


Figure 12 Electricity network plan

DRINKING WATER SUPPLY :

water resources in the wilaya of tindouf :

Water resources in the wilaya of Tindouf are underground resources in form of different aquifers:

Terminal vise limestone and dolomite aquifer, the main source of drinking water for the Tindouf area. It is located in Hassi Abdellah locality, with flows varying from 10 l/s to 45 l/s, and a mineralization of 2.4 g/l.

Hamadian nappe, which extends over the entire Hamada north of Tindouf, with flows ranging from 2 l/s to 15 l/s and mineralization ranging from 1.5 g/l to 2 g/l, and a high sulfate and chloride content.

Nappe des grès de l'ordovicien supérieur (Upper Ordovician sandstone nappe), a freshwater nappe, is located in the south of the wilaya around Gara Djebilet, with flow rates varying between 2 l/s and 12l/s, good chemical quality and mineralization of 0.6 g/l to 1.5 g/l.

Lower Devonian water table, located in the south of the wilaya, characterized by a low flow rate of around 02 l/s.

### **SEWAGE NETWORK :**

The sewage system is a combined sewer system, with a length of 146,879.23 meters, a connection rate of 97%, and several collectors. These all lead to the main sewer, which runs along the wadi that divides the town across its entire width from northwest to southeast. From upstream to downstream, it is made up of several diameters - Ø 400

Ø 500 - Ø 600 - Ø 700 up to Ø 800 which leads to the lagooning plant.

Moussani Ø 300 asbestos cement collector.

Remadine collector, Ø 300 and Ø 500 in asbestos cement,

Khengua collector, Ø 300 asbestos cement.

Ksabi collector, Ø 300 asbestos cement.

Sellagua collector, Ø 300 - Ø 400 - Ø 500 in asbestos cement

Hai Ennasr collector, Ø 300 in compressed concrete.

Oued Zez collector, Ø 400 - Ø 500 in asbestos cement,

Tindouf Lotfi (Hassi Amar) collector, Ø 400 - Ø 500 asbestos cement.

We also note that the locality is equipped with a sewage network that leads to septic tanks.

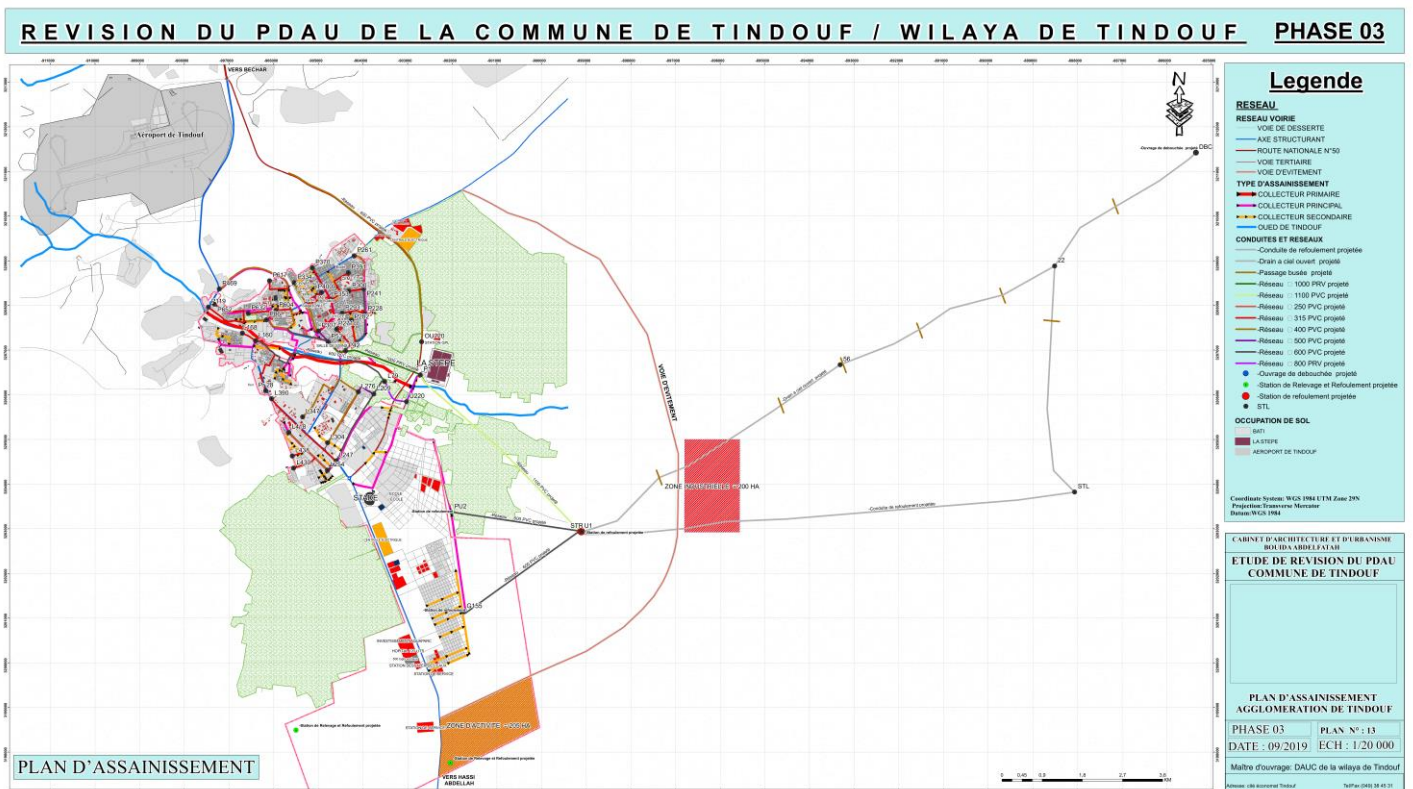


Figure 13 SANITATION PLAN

### RAINWATER:

There is no stormwater network, and runoff is natural and superficial. However, there is a flood zone right in the center of town. This zone is made up two sub-zones:

the first, which runs from the wilaya headquarters along the passage of the wadi between the two former districts of Moussani and Rémadine. This narrow section

of the wadi was first protected by a masonry wall on both banks, designed as a trapezoidal channel, with a height varying between 1.14 m and 1.60 m.

the second begins at the outlet of the wadi between the two districts, and runs along the entire length of the wadi. This area is much wider than the first, particularly where it meets the tributary that flows between Ksabi and ZHUN.

### **TELEPHONE NETWORK:**

ICTs, or information and communication technologies, have become a key factor in the attractiveness of a region.

At present, the Tindouf region is served by the full range of technologies available nationwide, including conventional telephony, i.e. the

"In addition to fixed-line telephony, there are three mobile operators: Mobilis, Djazzy and Nedjma. These operators are developing in line with the latest technological innovations, to keep up with the times and satisfy an increasingly demanding customer base.

The commune has 17 telephone centers with a capacity of 18,232 lines and a satisfaction rate of 60%. This rate is probably reduced by the interest now shown by users in mobile telephony, with a coverage rate of over 96%, and the Internet in general, bearing in mind that the town of Tindouf also has 15 cybercafés and 205 KMS. Compared with other wilayas, where it has all but disappeared, the latter type of service is still available in considerable numbers, mainly for people on the move such as military personnel, nomads and freight forwarders.

In terms of postal services, the commune has five post office receipts, one post office agency and one office counter. Postal density is as follows: one office for 7,642 inhabitants, one counter for 2,122 inhabitants, one receipt for 12,736 inhabitants.

### **MUNICIPAL WASTE COLLECTION:**

Currently, the waste generated by the population in the commune of Tindouf is around 42 tonnes/day, i.e. 15,330 tonnes/year of household waste, and 18.5 tonnes/year of special waste from hospitals, according to annual statistical yearbook of the wilaya of Tindouf for the year 2016. This waste is currently disposed of at two landfill sites, only one of which is controlled and covers an area of 21 hectares, while the second is unauthorized and covers an area of 65 hectares.

## **SPATIAL STRUCTURING AND URBAN ANALYSIS:**

### **Introduction:**

The commune of Tindouf is made up of two types: the main town, i.e. the town of the same name and Gara Djeibilet.

Tindouf's spatial evolution process:

The town of Tindouf, a single urban area It's rare to see the urban fabric of an entire commune resting on a single urban center, given the sheer size of the territory.

What's more, this unique center is linked to the rest of the country by a single highway Route Nationale 50, a kind of "umbilical cord" vital to almost all activities and dynamics of the Tindouf conurbation.

This concentration is the result of the area's very history, as Tindouf has been the only anchorage and settlement point for populations criss-crossing the region for several centuries, hundreds of kilometers away.

## **THE DISCONTINUOUS URBAN STRUCTURE OF THE TOWN OF TINDOUF:**

The city's urban structure, and consequently its growth, are conditioned by natural constraints to which are added, over time, artificial or created constraints (power lines, gas pipes, classified equipment or facilities, etc.).

Indeed, the Oued Tindouf and its tributaries, the Oued Zez and Oued El-maâ, divide the town into several parts reminiscent of the different stages in growth. To these wadis must be added the constraints of the ridges around and within the urban fabric, which represent veritable "urban barriers". Five units stand out:

The first two units are made up of the old quarters - historic and colonial - with their share of transformations over time.

The Rémadine and Ksabi districts confined between Oued El-maâ and Oued Tindouf, as well the ridge to the north,

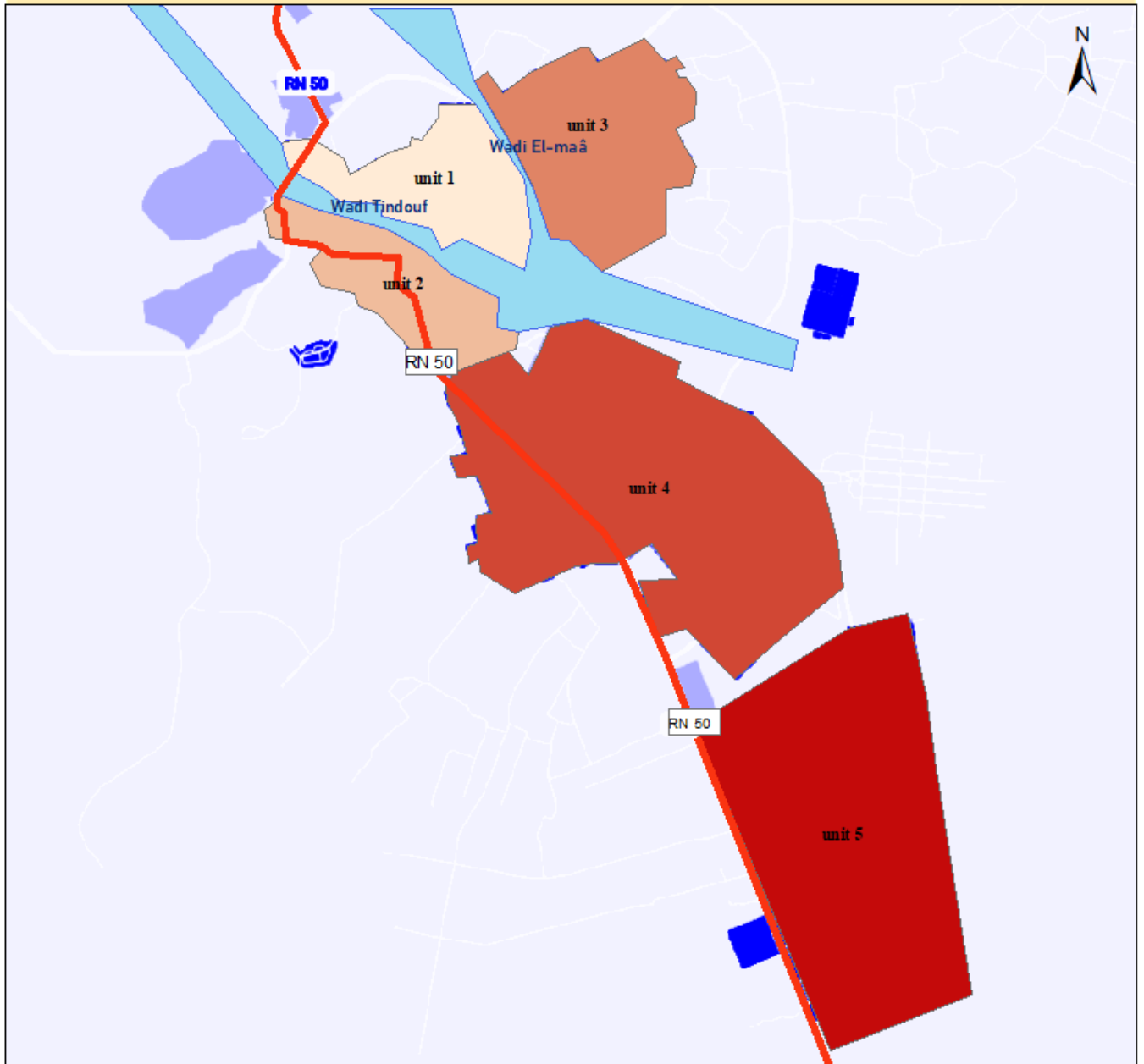
The Moussani, El-Mouggar and El-Badr districts are confined between Oued El-Maâ on the one hand and the ridges to the south and east on the other.

The third, which merges with the ZHUN and its continuities, confined between the Oued Zez and the third tributary of the Oued Tindouf, as well as the ridge to the north,

The fourth unit comprises Hassi Ammar, the business park and the extension near the university center. It borders Oued Tindouf, the military zone to the west and the ridges to the north.

The fifth unit is the new extension to the south of Hassi Ammar, with a huge rural housing program. It is characterized by its linearity, following one side of the RN 50 axis towards Hassi Abdallah.

## Tindouf's spatial evolution process



— RN50

— Oued

### units

### units

— unit 1 The Rémadine and Ksabi

— unit 2 The Moussani, El-Mouggar and El-Badr

— unit 3 ZHUN

— unit 4 Hassi Ammar

— unit 5 the south of Hassi Ammar

Figure 14 Tindouf spatial evolution process

- **THE URBAN STRUCTURE**

is built around three main axes:

- a- The primary route is the RN 50,
- b- The first siding links the ZHUN with the Hassi Ammar business park.
- c- The second siding to the east of the town.

In fact, all the main roads serving the old town - historic districts and colonial quarters - originate from the primary road, the RN 50. They provide easy access to the town, particularly to the Rémadine and colonial village districts. As for the Moussani district, access is slightly less easy, as continuity is broken by the wadi, even though the latter, like all other wadis, is only slightly incised. Discontinuities and breaks in the urban fabric are becoming increasingly evident with new extensions. The ZHUN is virtually encircled by wadis and ridges, even though accessibility is ensured by the eastern extension of the main roads leading from the old core, and the first bypass road linking the ZHUN to the industrial zone and Hassi Ammar.

Discontinuities and fractures are further exacerbated when it comes to the business park and the adjacent neighborhoods to the east and west. Indeed, the wadi, ridges and agricultural land are all constraints, and accessibility is ensured by a single axis: the siding to the east of the town.

- **URBAN MORPHOLOGY**

The city of Tindouf has a diversity of urban forms. This diversity is in fact the result the juxtaposition of different fabrics corresponding to the different stages of its growth, from its birth, a long time ago, to the present day; each stage leaving its mark on the formation and transformation of the urban fabric. This diversity can be seen both in the grid and in the urban forms and fabrics.

At the same time, this diversity is a source of richness and contributes to the region's attractiveness, lifestyle and identity. The elements of the urban landscape, combined with the area's history, help to build the strong identities that characterize the different areas.

In addition, the assessment of the urban fabric's capacity to evolve must be based on an analysis of the existing fabric, in other words, a typo-morphological analysis, in order to be able to give an opinion on the future through the urban project and the territorial project. The aim of the latter is to meet the challenges of improving, preserving and enhancing the living environment.

### **1. FUNCTIONAL DYSFUNCTION: UNBALANCED DISTRIBUTION OF URBAN FUNCTIONS.**

Overall, connections between the various neighborhoods are becoming increasingly fluid, despite the constraints mentioned above. This fluidity is ensured by a large number of secondary roads. These provide a link between the main roads on the one hand, and services within the neighborhoods on the other. These junctions are usually in the form of more or less important roundabouts.

However, analysis within the various neighborhoods reveals functional differences and dysfunctions

The old core - Ksabi and the surrounding area in particular - which is today's city center, remains the point of convergence and divergence of a major flow of traffic. It is the part of the city with the most facilities and the best organization. Although the residential function has long been dominant in these districts, we are increasingly witnessing the reallocation of real estate, with a proliferation of shops and services, and even equipment on the ground floor of homes. However, the Mouggar, El- Badr and El-Khenga neighborhoods, despite their relative age, are deficient in both organizational and functional terms. These are peripheral,

off-center neighborhoods with, in particular, local school and administrative facilities and a multitude of private parks.

Paradoxically, it is in the ZHUN (zone d'habitat urbain nouvelle - new urban housing zone) and particularly in the Sellaga district that the notion of reorganization-restructuring finds its meaning, insofar as such an intervention would be possible, given that this zone has been the subject of a POS study. In this area, the built environment is highly disjointed: urban functions are poorly arranged, the road network is unsuitable, and there are no urban landmarks. The example of the ZHUN' central boulevard is a good illustration of these functional difficulties: its large dimensions, the fact that it opens onto roundabouts providing important connections, and the random layout of buildings along this axis make its redevelopment complex and its animation problematic.

Most of the city's new extensions, despite their recent creation, present organizational and functional dysfunctions:

- o Public spaces are generally residual spaces resulting from constraints linked to existing easements. They do not contribute to the production and organization of urban fabrics.
- o Absence of a clear hierarchy of roads - the road system is confused - and of structuring elements and places,
- o The presence of a large number of imposing administrative facilities alongside local standard facilities,
- o The town's underdeveloped commercial and service infrastructure means that it is clearly dependent on the old town.

This implies a search for a balance of urban functions between the various neighborhoods through central hubs, to enable these hubs to function properly on the one hand, and reduce pressure on the town center on the other.

Finally, there is a lack of public green spaces. The town of Tindouf has 15 ha of green space, including airport green space (3 ha) and the park.

family of 6 ha, i.e. a ratio of 2.2 m per inhabitant, which is still five times lower than the minimum of the standard of 10 m per inhabitant.

However, while the need for green spaces has been mitigated by plans to create green belts and the 150-hectare recreational forest to the north of the conurbation, this space must be considered an essential component of urban planning, helping to create a quality living environment and overall ambiance for residents.

**b. Housing typology:**

Distribution of inhabited dwellings by type of construction:

Type of construction	Buildings	House individual	House Traditional	Other ordinary	Const. precarious	ND	TOTAL
No. of units	1028	6658	265	36	655	39	8681
Ratio	12%	77%	3%	-	8%	-	100%

Source: final results statistical data n°527/37 ONS

The urban fabric of the city of Tindouf is dominated by two types of housing: individual housing in the older areas and semi-collective housing in the newer areas; and, to a much lesser degree, collective housing, particularly in the ZHUN. Note also the predominance of individual housing in the new extension to the south of the town, along with rural housing.

### III. PRESENTATION OF OCCUPATION LAND NUMBER 3

#### Neighborhood Analysis: Occupation Land Number 3 – Tindouf

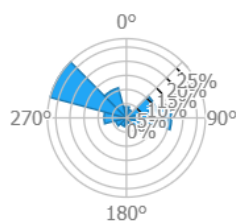
##### 1. Geographic location

Occupation Land Number 3, located in the northern part of Tindouf, covers approximately **22 hectares** and represents a pivotal zone in the city's urban fabric. It combines residential, commercial, and public service functions, making it a microcosm of broader urban dynamics in the region.

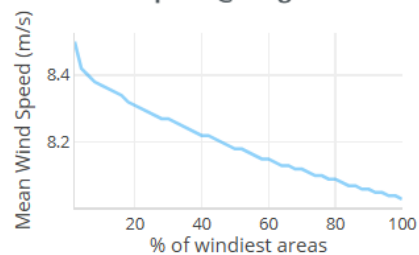


Figure 15 location of occupation land number 3

Wind Frequency Rose



Mean Wind Speed @Height 100m



## 2. Administrative boundaries

Pos3 is a territorial unit situated within a broader administrative framework, bordered by the neighboring areas of Moussani and Remadina. Administratively, Pos3 falls under the jurisdiction of Ksabi.

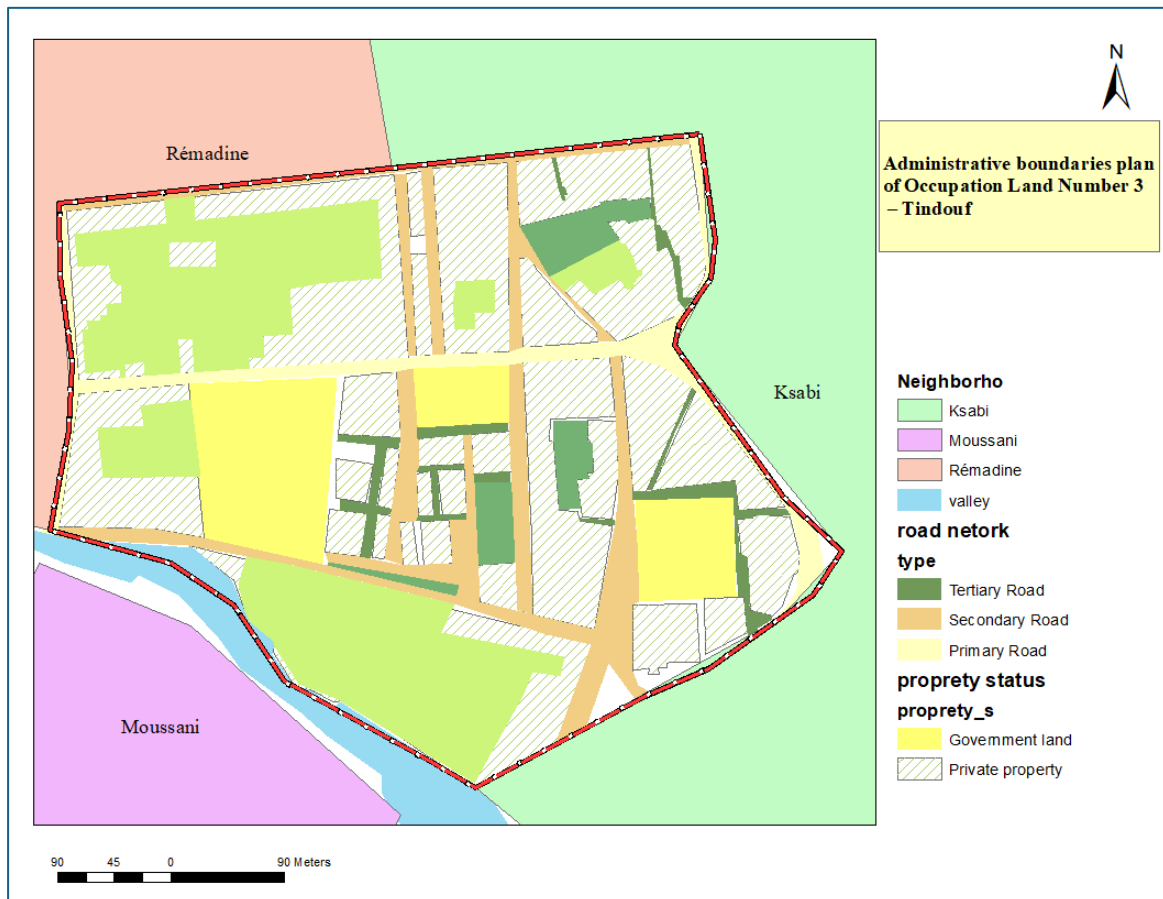
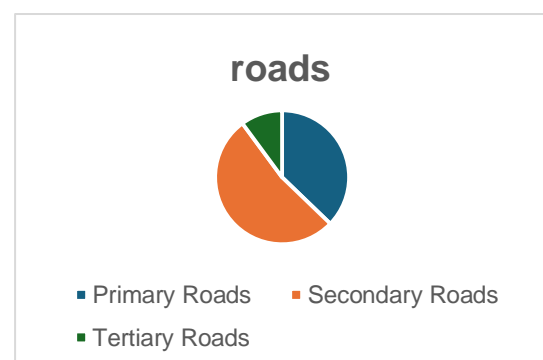


Figure 16 Administrative boundaries of occupation land number 3

## 3. Accessibility:

The neighborhood has a **structured road network**, with:

- **Primary Roads: 37.2%**
- **Secondary Roads: 52.7%**
- **Tertiary Roads: 10.1%**



Main roads are generally in good condition and facilitate smooth circulation. However, tertiary roads are often narrow and poorly maintained, which impairs local accessibility, especially in peripheral or densely

image 3 Primary Road



image 2 Secondary Road



image 1 Tertiary Road

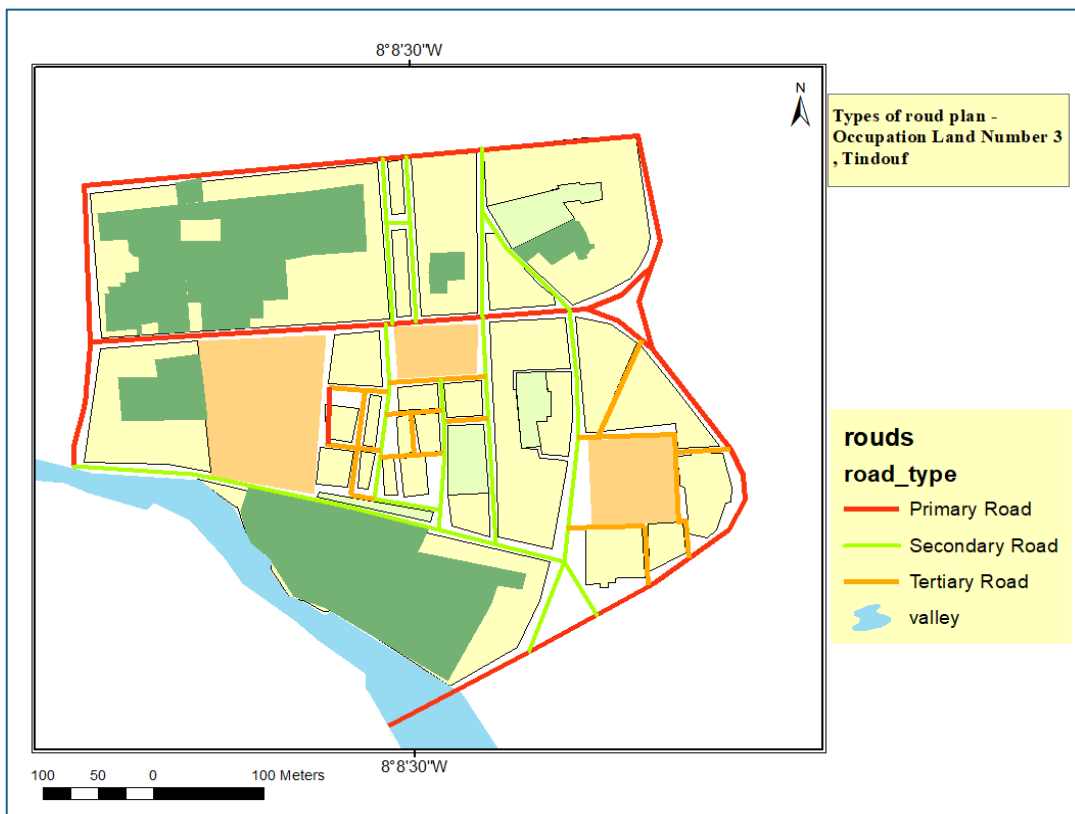


Figure 17 type of road

- The circulation plan (Fig. 17) prioritizes vehicular access through primary and secondary entry points, while tertiary roads often terminating within parcels reflect a service-oriented rather than through traffic design.

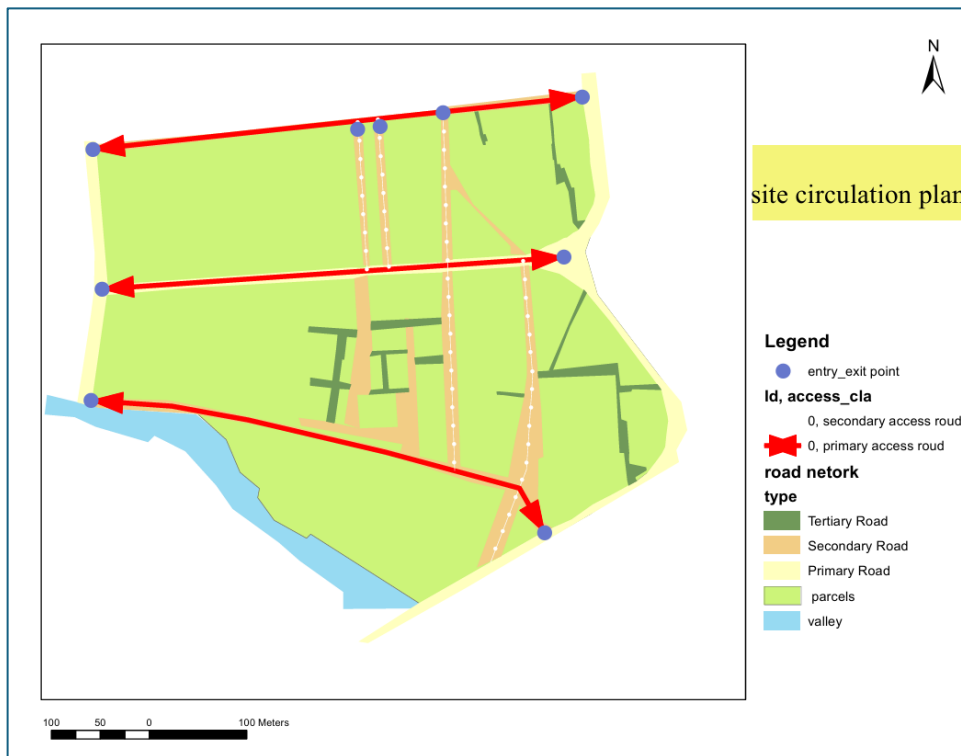


Figure 18 The circulation plan

- Functional road classification in Occupation Land No. 3 (Tindouf) showing transportation routes, with Salam Alikom Road serving as the sole commercial corridor (business-lined street) amidst otherwise purely transport-focused roads.

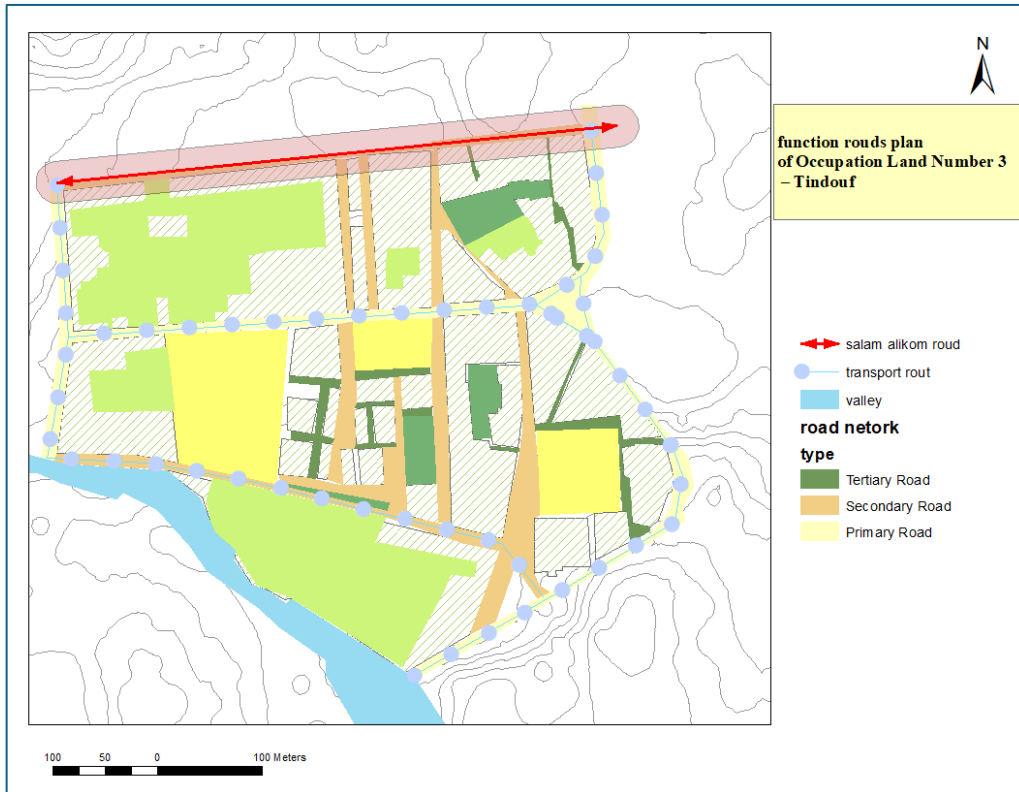


Figure 19 Functional road



image 5 Salam Alikom Road

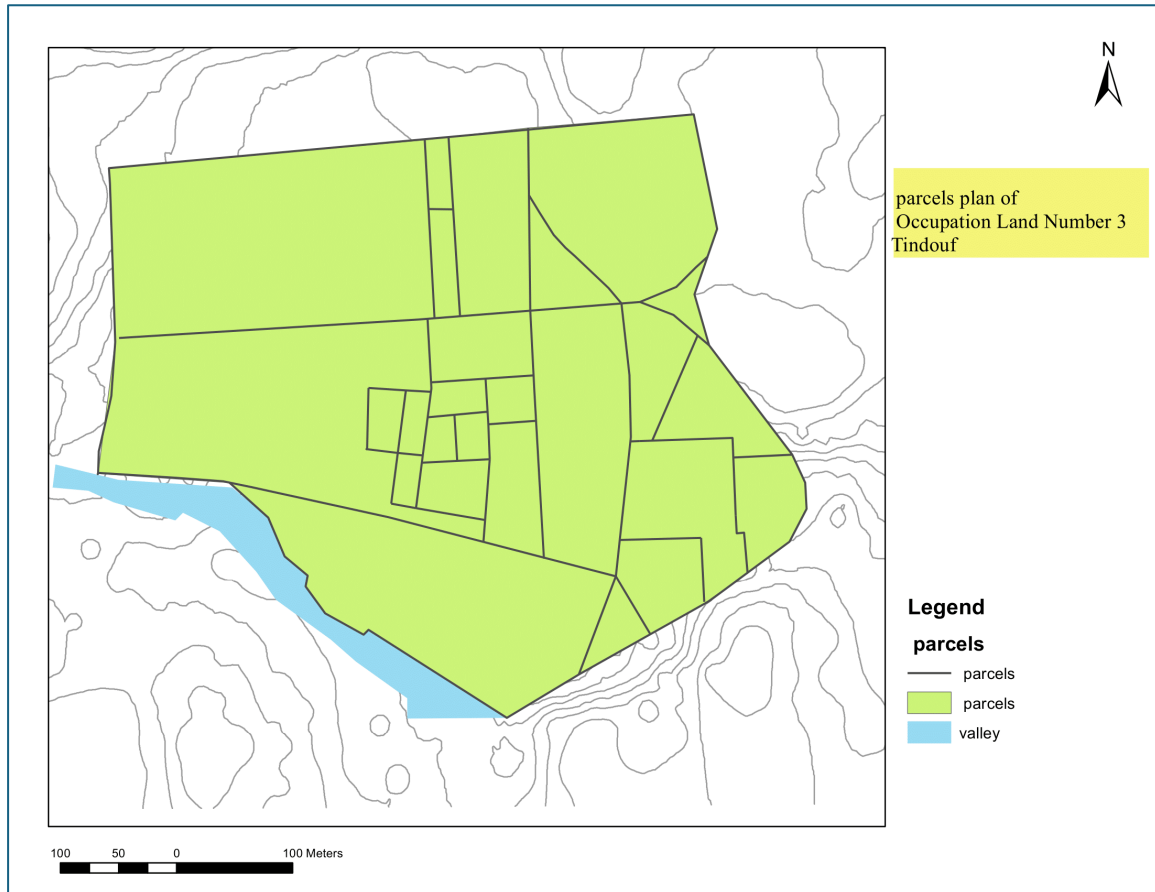


image 4 Salam Alikom Road

#### 4. Morphological

These two plans present a comparative view of land division in Zone 3 of Tindouf. The **parcels plan**, highlights the subdivision of land into large property units.

*Figure 20 parcels plan*



The **urban islands plan**, focuses on built-up zones and the road network structure.

The comparison reflects different planning approaches ownership vs. functional



Figure 21 The urban islands plan

use offering insight into urban form, accessibility, and development potential.

## 5. Land Use and Property Status

The majority of the land is under **private ownership (85.2%)**, while **14.8% remains government property**. The built-up area occupies around **6.9 hectares**, or **31.36%** of the neighborhood's total area. Notably, **individual housing** represents **28.64%**, while facilities account for **2.86%**, indicating a predominance of residential use.

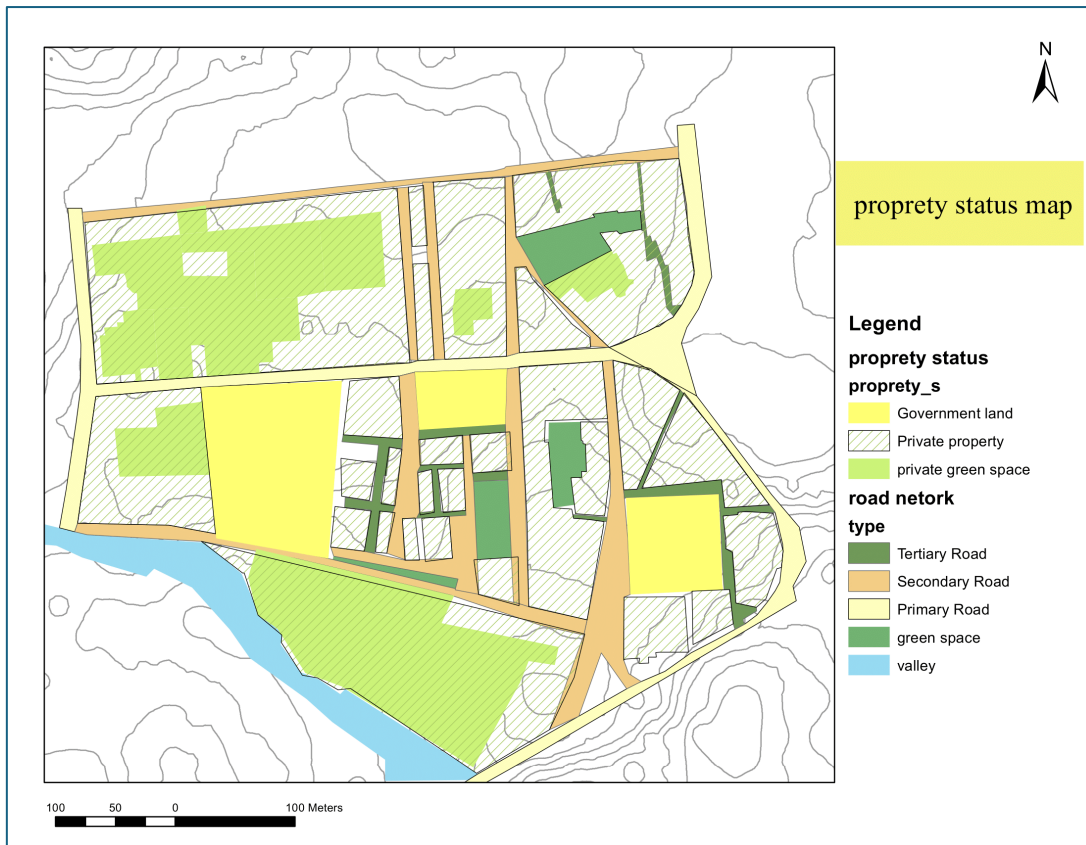


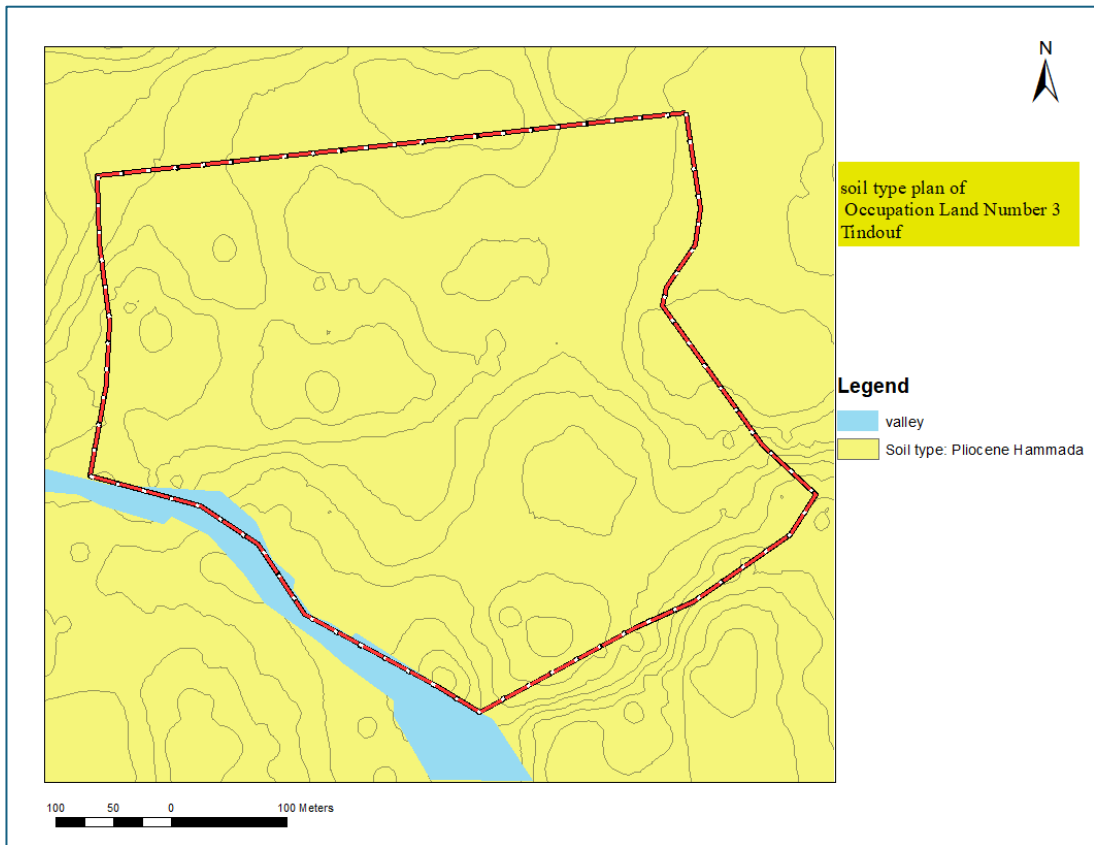
Figure 22 Property Status plan

## 6. Soil Type

This plan illustrates the dominant soil type and current land occupation number 3 of Tindouf. The area is primarily composed of Pliocene Hammada, a compact, stony soil with limited permeability.

This soil type affects construction methods and foundation design, as outlined in the geological cross-section.

Understanding the relationship between soil conditions and land use helps guide future urban planning and development.



## 7. Topographic section

The elevation profile of its ground having just a 2.95 meter change in elevation over a 553 meter distance gives the site a very shallow slope. Average slope

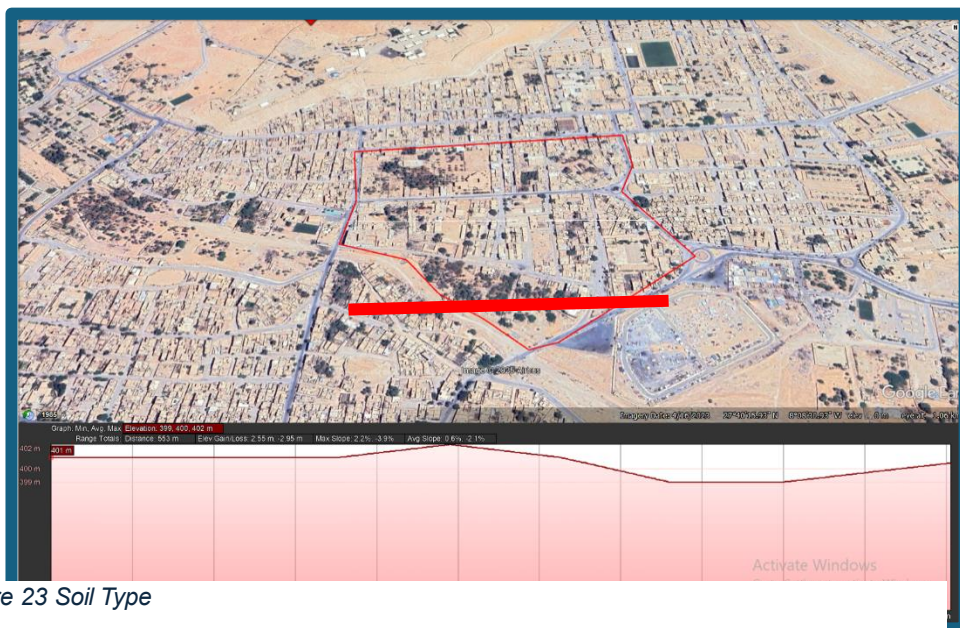


Figure 23 Soil Type

comes out to be less than 2.1%, clearly showing flat terrain of here The topography is such that it is friendly to urbanization Increase opportunities to develop the road, decrease earthwork cost and enables water for hygiene distribution properly. Further more limited slope decreases drainage problems or erosion.

## 8. Elevation

The Digital Elevation Model (DEM) shows the topography of the vicinity. Topographic heights within the site vary between about 389–412 m, reflecting a generally stable and flat interior. Surrounding areas, especially in the southeast-northwest direction, demonstrate upward elevation to greater than 420 m, this subtle topographic encasement could confine runoff and reduce impingement brought about by external surface. The elevation uniformity facilitates the

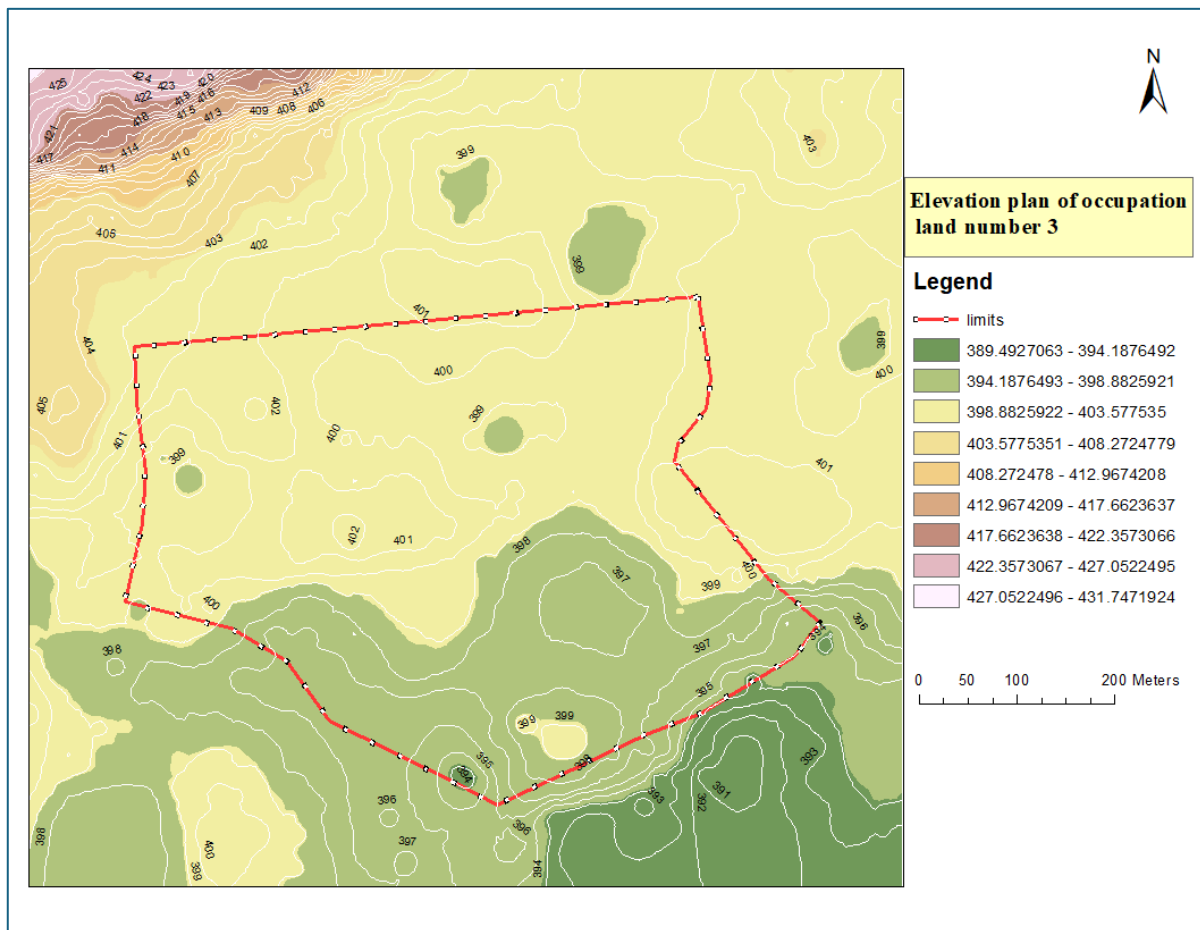


Figure 25 Elevation plan

construction of infrastructure and simplifies the layout of transportation and utility networks.

### 9. Potable Water Network:

This map depicts water infrastructure (AEP) across the neighborhood. There are pipelines already serving most roads, especially secondary and tertiary ones. This observation reveals a well-dispersed functional water network. The installation of the water network, in close proximity to the valley in the southwest of the Site, poses the possibility of contamination or damage, in the event of a storm run off or flood event. The road hierarchy follows the water network distribution, facilitating maintenance and further extension.

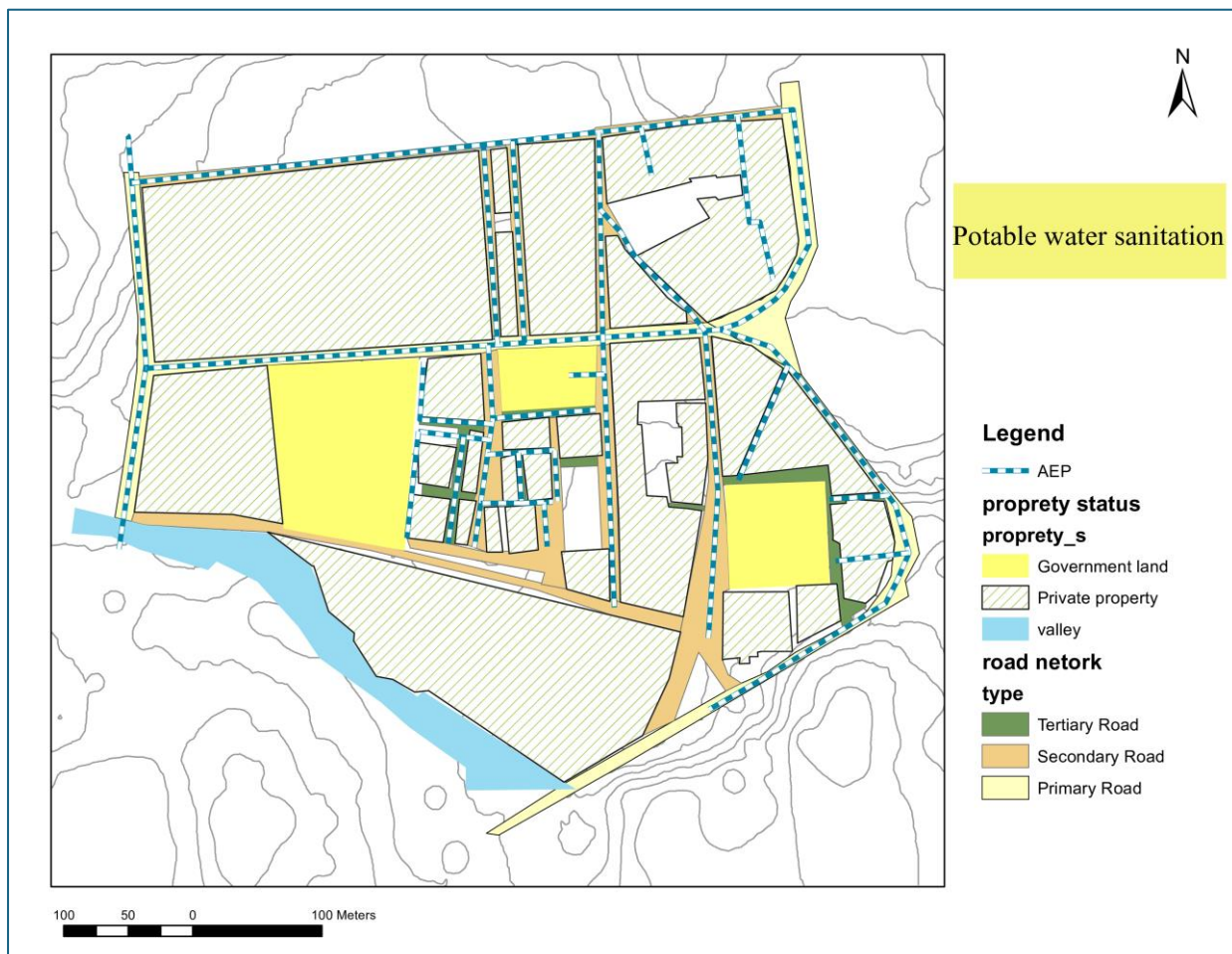


Figure 26 Potable Water Network plan

## 10.Easements diagram

The easement map highlights key constraints within the neighborhood, notably in the form of infrastructure and natural features. Gas easements are present along the northern and southeastern boundaries of the site, indicating areas where construction and development are restricted due to underground utility lines. Additionally, the southern and southwestern edges are defined by a valley, which also serves as a natural easement. These elements play a significant role in shaping the urban fabric, as they impose limitations on land use and influence circulation patterns, green space planning, and potential expansion zones. Recognizing these easements is essential for guiding sustainable and context-sensitive urban interventions.

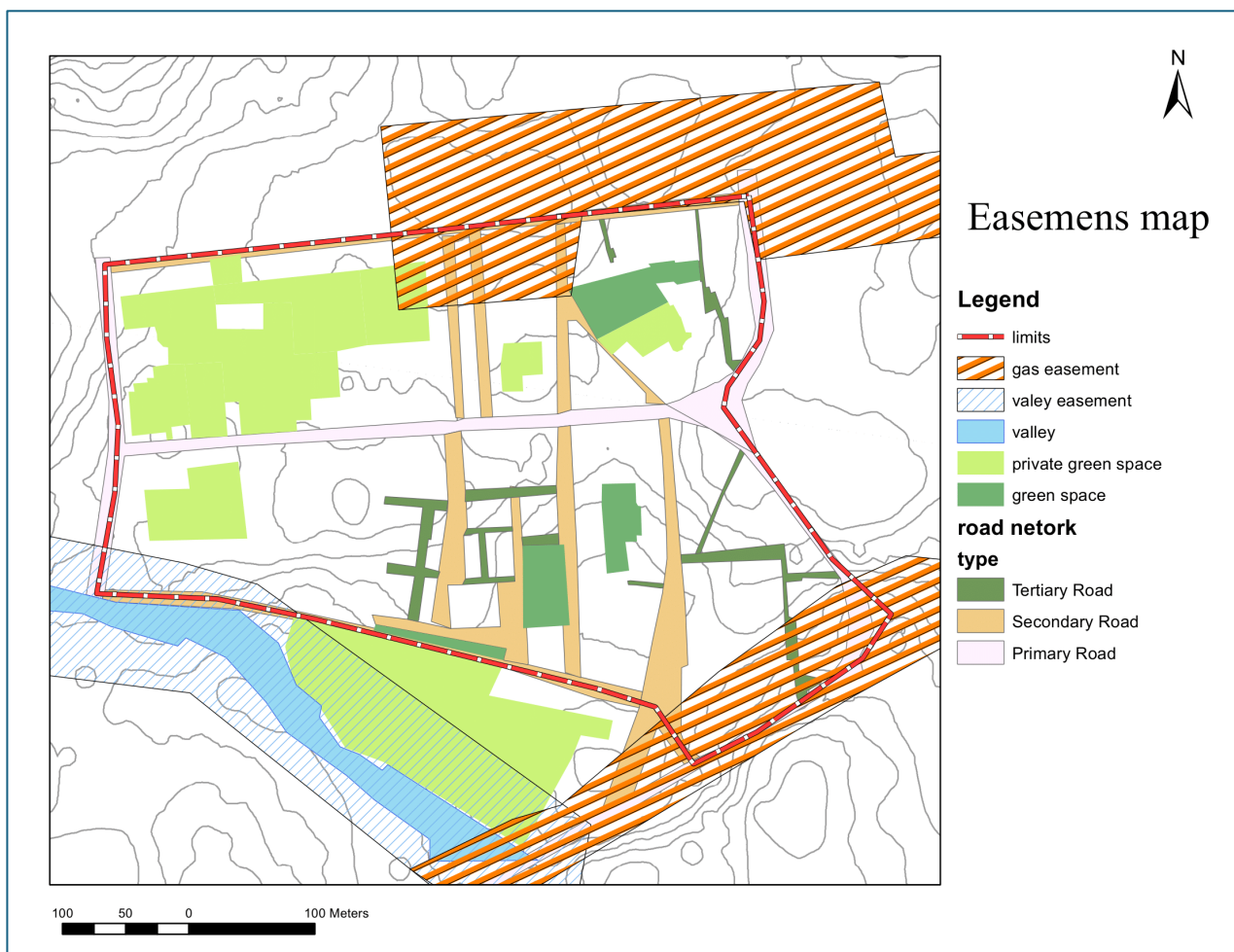


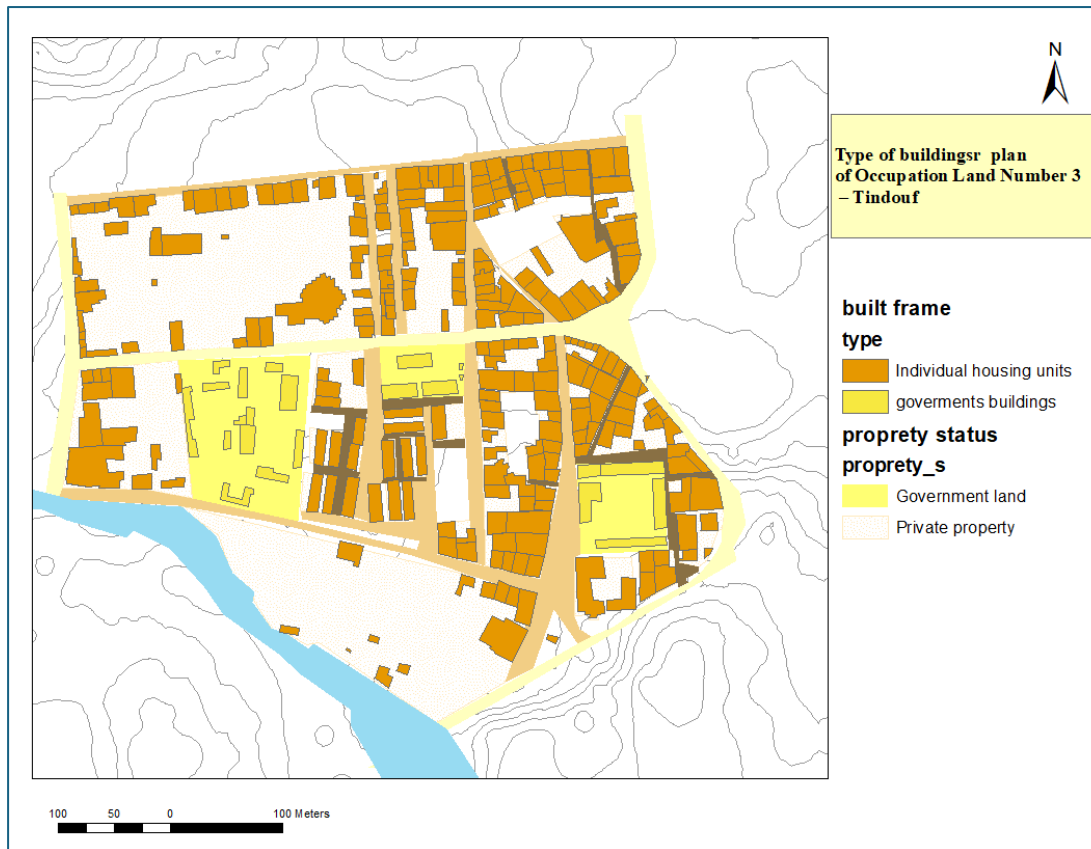
Figure 27 Easements plan

## 7. Types of housing:

The built frame typology implies single housing and demonstrates the character of the area. The quality of the housing, and indeed the visual coherence of it, is generally low here, despite this residential sameyness. The buildings are poorly organized and lack in harmony and continuity, making an irregular urban texture. It gives the impression of being under-construction, or under-maintained: Many buildings are half-finished or falling apart, there are no paved roads around the clusters of houses. This creates a rural or historically “stuck in time” look to the neighborhood rather than the design and organized feel of what should be a newer urban area. These conditions underline the urgency of architectural legislation, urban reconstruction schemes



*image 6 individual houses*



## 8. Public Services

In addition to the facility map, a radius-based influence study was conducted on five key public services frequently used by residents in Algerian neighborhoods:

- Primary School
- Middle School
- High School
- Mosques
- Healthcare Units

Each service was analyzed using a standardized influence radius:

- Primary School: 500 meters
- Middle School: 700 meters

- High School: 1000 meters
- Mosques: 500meters
- Healthcare Facilities: 600 meters.
- Based on these radi, the entire neighborhood falls within the service areas of surrounding facilities. The spatial analysis confirms that the neighborhood currently has no immediate need for additional public services or facilities. It is functionally integrated with its urban context and well served by existing infrastructure.

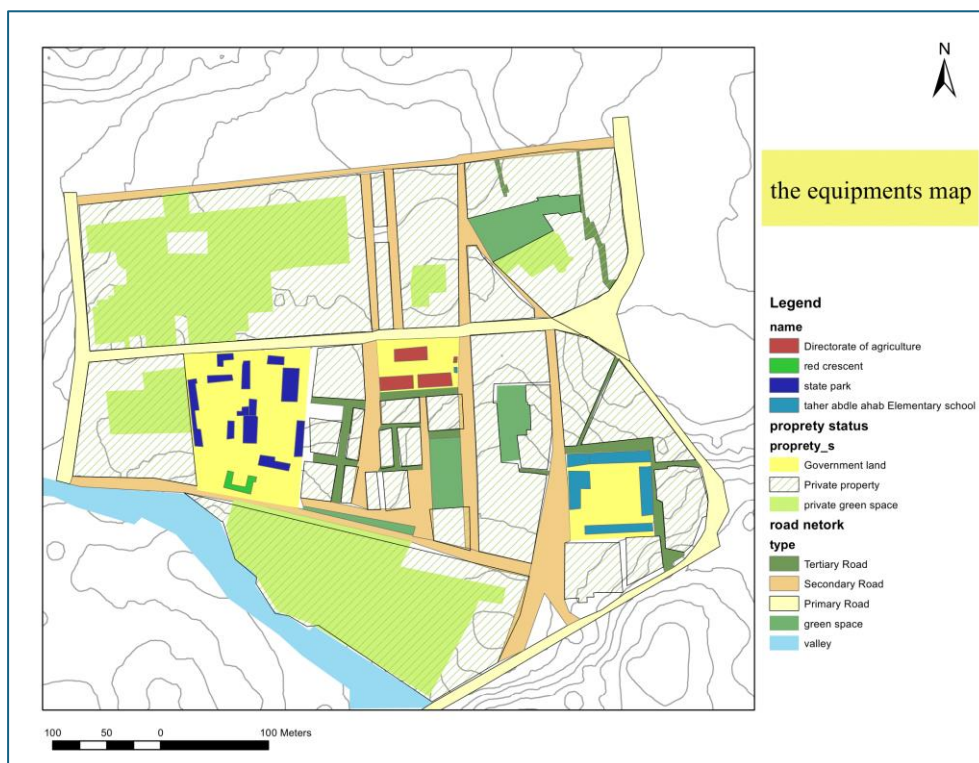


Figure 29 facilities plan

Figure 30 the mosque's radius of influence

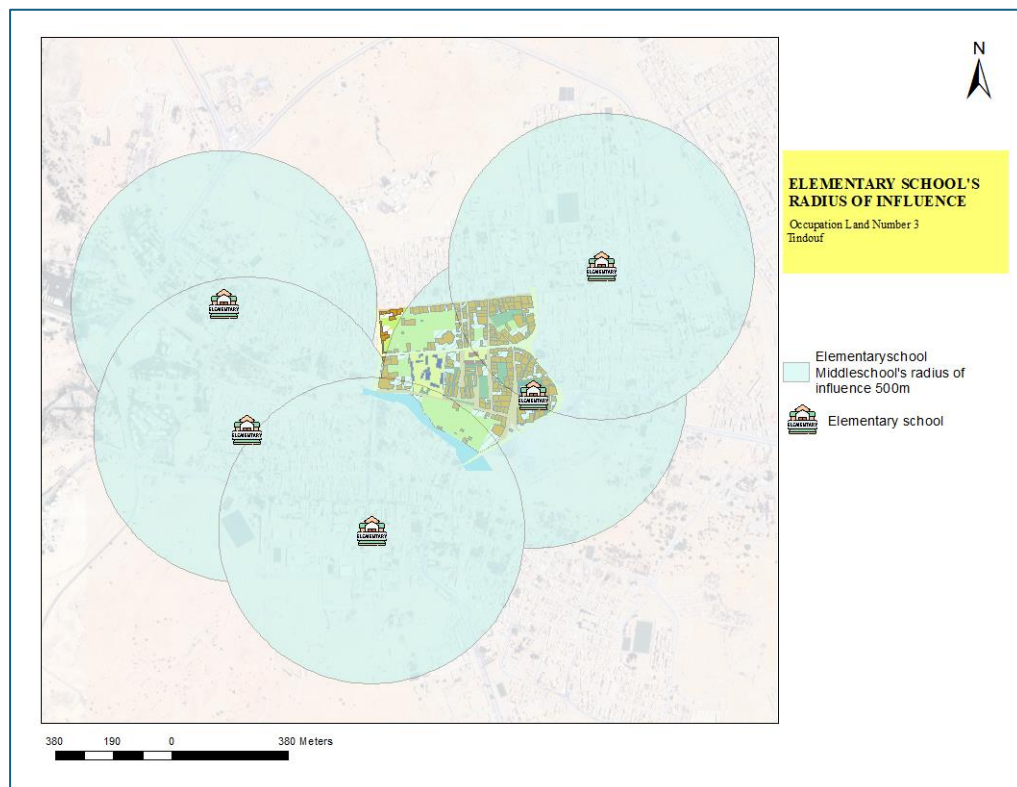
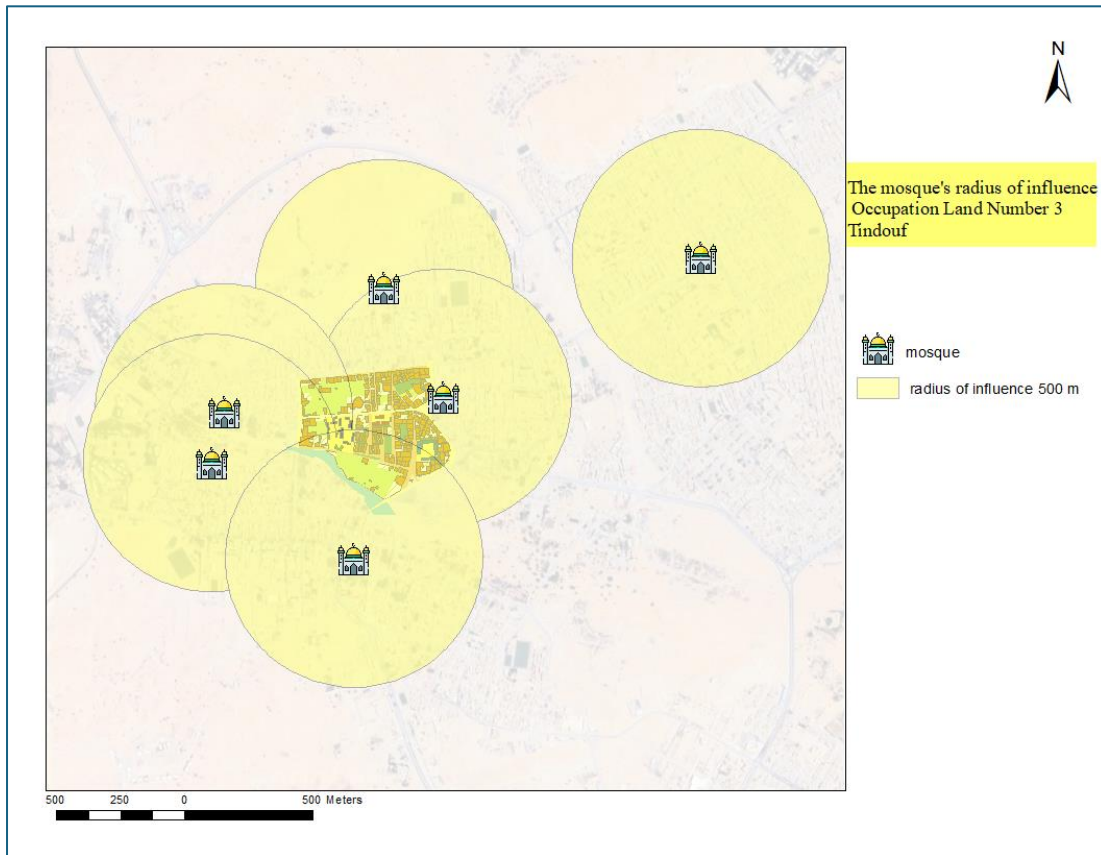


Figure 31 elementary's radius of influence

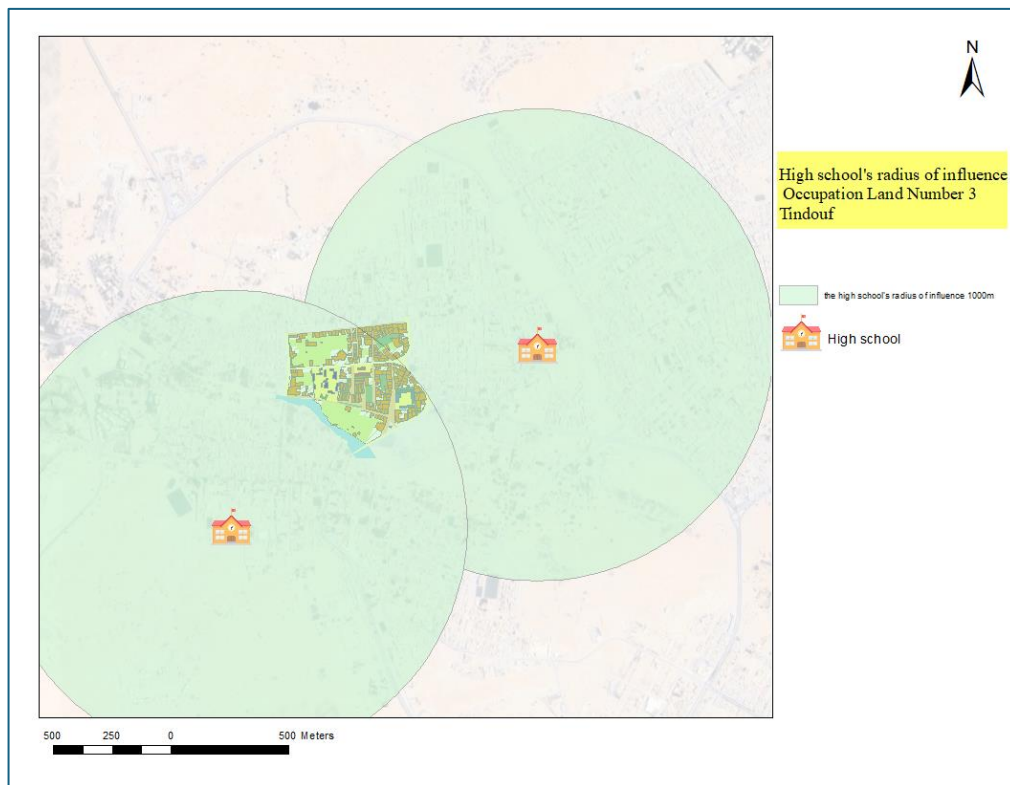


Figure 32 high school's radius of influence

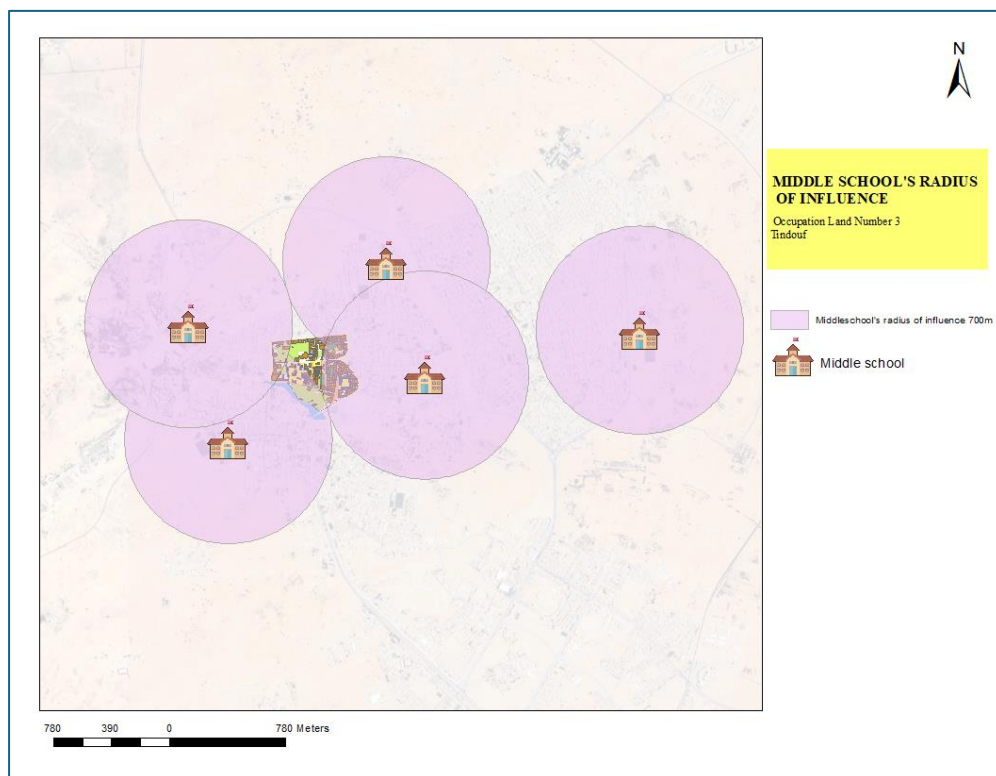


Figure 33 middle school's radius of influence

## 9. Environmental Risks and Waste Management

The proximity of residential zones to **waste accumulation points** and natural water sources introduces health and ecological risks. Current waste management is insufficient, and strategies such as **landfill relocation, recycling, and dedicated disposal sites** are essential to mitigate impacts.

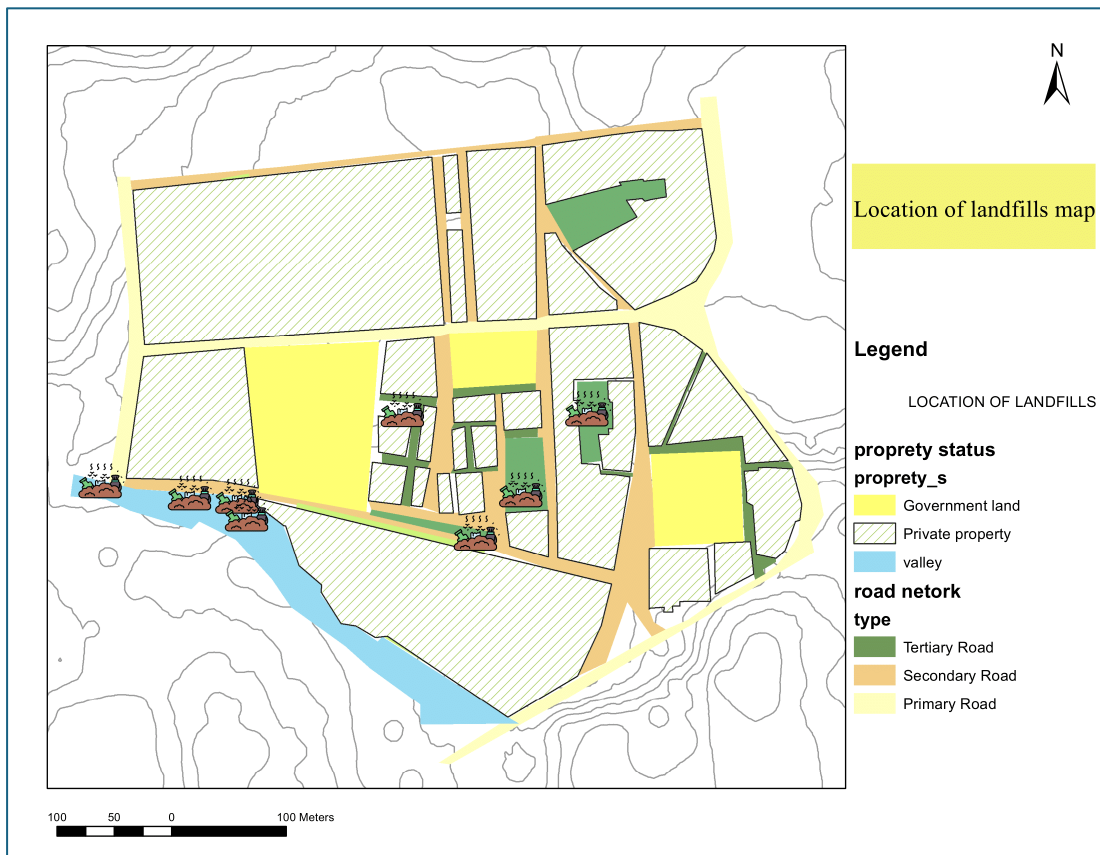


Figure 34 landfills location

## **10.VEGETATION COVER:**

The study area presents a vegetation cover characterized by a clear concentration of green elements in the southern and western parts of the neighborhood. These areas contain a higher density of vegetation compared to the central and eastern zones, which show a notable lack of green spaces. The vegetation includes palm trees, pine trees, public green areas, and private green spaces. These components contribute to essential ecological functions such as soil stabilization, surface runoff regulation, and local climate improvement. The presence of dense vegetation along the river and near residential areas indicates the environmental value of these zones. This natural context also reflects the imbalance in the green network, highlighting areas that require targeted urban planning interventions to restore ecological balance and enhance environmental quality.

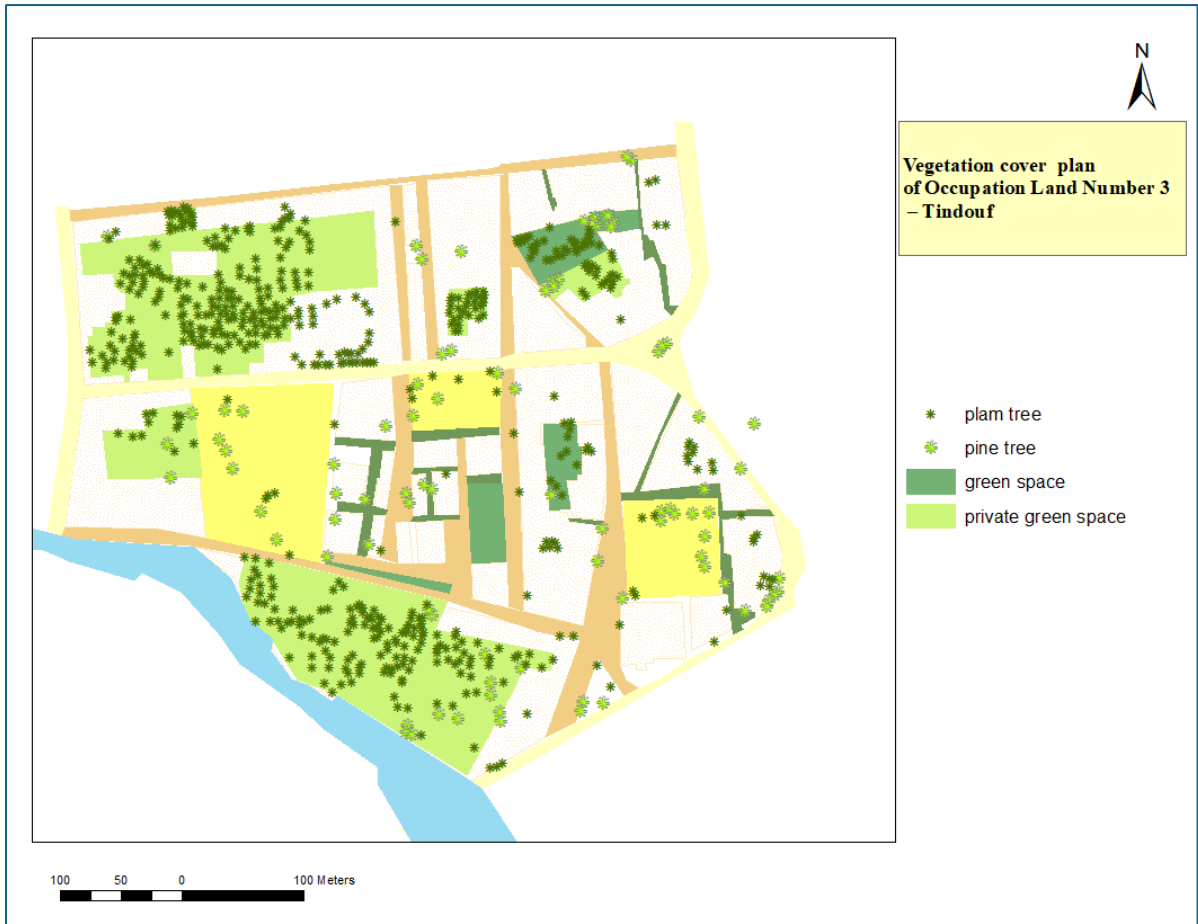


Figure 35 Vegetation Cover



image 7 Private Palm Tree Area

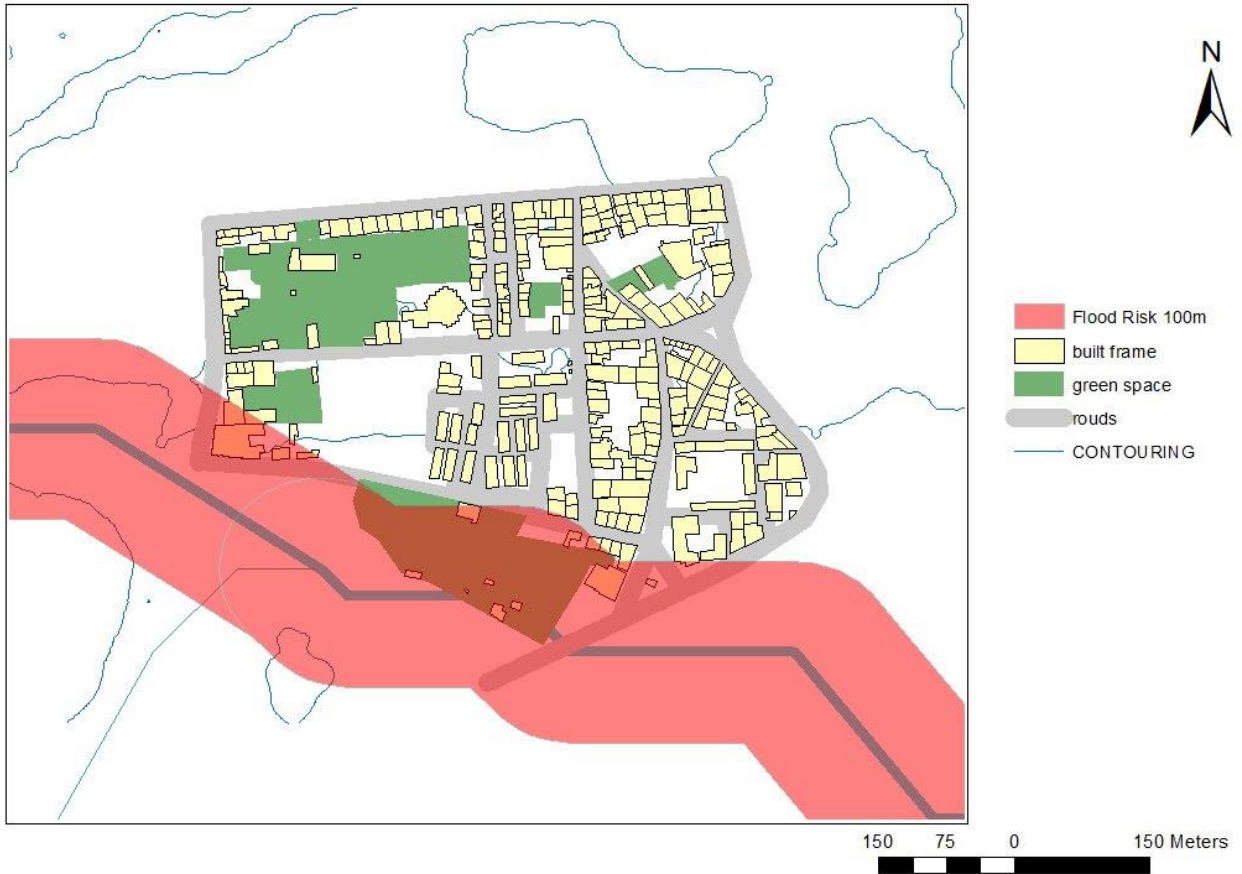
## 11. FLOOD RISK ASSESSMENT

The total surface area of the watershed covering the study zone is approximately 208,525 hectares (2,085.25 km<sup>2</sup>). This large catchment area collects significant volumes of water during periods of rainfall. Although precipitation is generally rare in this region, when it occurs, it tends to be intense and short, producing large amounts of surface runoff in a short time. The local topography, characterized by very gentle slopes between 0% and 3%, slows down water drainage, causing water to accumulate and spread across the flat terrain. This increases the potential for flooding, particularly near the natural drainage lines and around the sebkha, where water naturally converges.

Furthermore, the buffer analysis carried out in GIS using a 100-meter buffer around the main oued revealed that many parts of the urban fabric fall within zones highly exposed to overflow. This buffer distance was chosen based on the limited slope and the known spread of water in similar terrain profiles. The area's geological structure mainly sandstone and clay-rich formations also contributes to limited water infiltration, further enhancing runoff.

Considering all these factors large drainage basin, low slope, flat topography, shallow infiltration, and proximity to temporary watercourses—the site is clearly vulnerable to flash flooding. Urban development in these areas must account for this hydrological behavior to prevent damage and ensure long-term sustainability.

**Flood Risk Map – Land Occupancy Plan 3, Ksabi-Chlef, Tindouf**



*Figure 36 flood risk map*

**Conclusion:**

This chapter provided a comprehensive overview of the urban context of Tindouf Province, focusing on its geographic isolation, administrative structure, and evolving urban dynamics. It examined the spatial characteristics of the Tindouf Commune and narrowed down to Occupation Land No. 3 in the Ksabi-Chlef neighborhood, the main site of field investigation. The analysis revealed several pressing urban issues that affect the quality of life and hinder sustainable development. These include degraded road infrastructure, absence of green and shaded areas, widespread environmental and solid waste pollution, unregulated parking practices, lack of pedestrian infrastructure and walkability, shortage of public gathering spaces, exposure to flooding and water risks, and functional overlap between land uses. Together, these factors point to a lack of coherent urban planning and ineffective space management. This diagnostic assessment lays the groundwork for the next chapter, which proposes targeted urban interventions aligned with planning standards, environmental sustainability, and community needs.

CHAPTER 3: URBAN  
INTERVENTION- RESTRUCTURING  
KSABI-CHLEIF NEIGHBORHOOD

## **Introduction:**

The Ksabi-Chleif neighborhood in Tindouf suffers from several urban problems. These include visual disorder, poor circulation, lack of comfort, weak environmental design, and bad waste management. These issues reduce the quality of life, harm the neighborhood's image, and limit its potential.

This chapter proposes a set of targeted interventions to solve these problems. The goal is to improve the neighborhood's beauty, livability, and sustainability through realistic and practical actions. Each intervention is based on specific urban planning standards and tailored to the site's local context.

The plan covers the redesign of facades, improvement of public spaces, creation of a clear road hierarchy, better waste container placement, and greening the streets using native plants. It also sets clear rules and criteria for how each action should be applied and maintained.

The interventions are grouped under three main axes:

- Urban beauty
- Livability and comfort
- Environmental sustainability
- Flood risk management

Each part includes an explanation of the existing problems, proposed actions, and the standards guiding them. The final goal is to build a functional, attractive, and clean urban space that meets the real needs of its residents.

## **OBJECTIVES OF THE RESTRUCTURING**

- Improve the visual and physical quality of the urban space:

Upgrade roads, façades, and public spaces to enhance the image of the neighborhood

Ensure aesthetic coherence and functional clarity in the built environment

Address visual pollution through coordinated urban design interventions

- Reduce environmental stress:

Mitigate air and soil pollution by introducing waste management zones and planting vegetation

Lower surface temperatures by creating shaded areas, green corridors, and permeable surfaces

Control and reduce flood risks by implementing proper drainage systems and water flow strategies

- Encourage social interaction and enhance walkability:

Design accessible pedestrian paths and protected walkways

Develop public squares, shaded rest areas, and seating to support informal gatherings

Prioritize pedestrian movement in commercial and residential zones to create a people-centered environment

- Introduce sustainable and resilient urban elements:

Integrate green infrastructure such as trees, shrubs, and eco-friendly materials

Promote energy-efficient lighting and water conservation techniques

Ensure long-term maintenance plans and community involvement for sustainable outcomes

- Restore the intended public garden:

Reclaim the abandoned plot currently used as a waste dumping area

Transform it into the public green space originally planned

Design it as a functional, clean, and accessible garden that serves environmental and social roles

Prevent future misuse by applying spatial boundaries, lighting, and regular maintenance

- Address flood risk through targeted mitigation strategies:

Recognize flood vulnerability identified during the site analysis

Propose practical solutions such as two pedestrian bridges and a reinforced drainage system Recommend integrating these measures into future planning documents and municipal actions to reduce exposure and improve safety.



Figure 37 problem identification plan

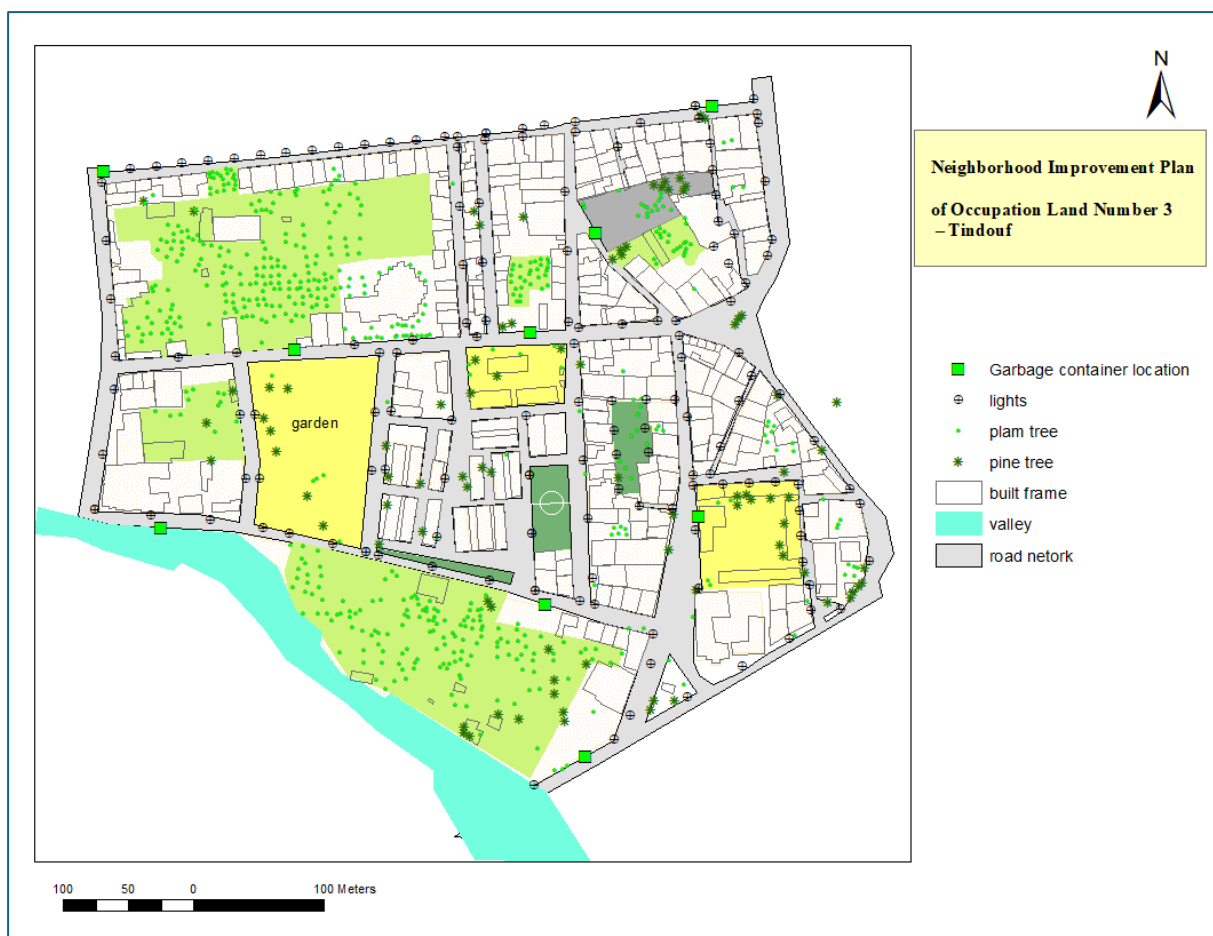
## KEY URBAN ISSUES IN QSABI-CHLEF NEIGHBORHOOD

- Degraded Road Infrastructure
- Absence of Green and Shaded Areas
- Environmental and Solid Waste Pollution
- Unregulated Parking Practices
- Lack of Pedestrian Infrastructure and Walkability.
- Shortage of Public Gathering Spaces
- Exposure to Flooding and Water Risks
- Functional Overlap and Activity Conflicts

## GENERAL SOLUTIONS

- Rehabilitate damaged roads and apply uniform paving

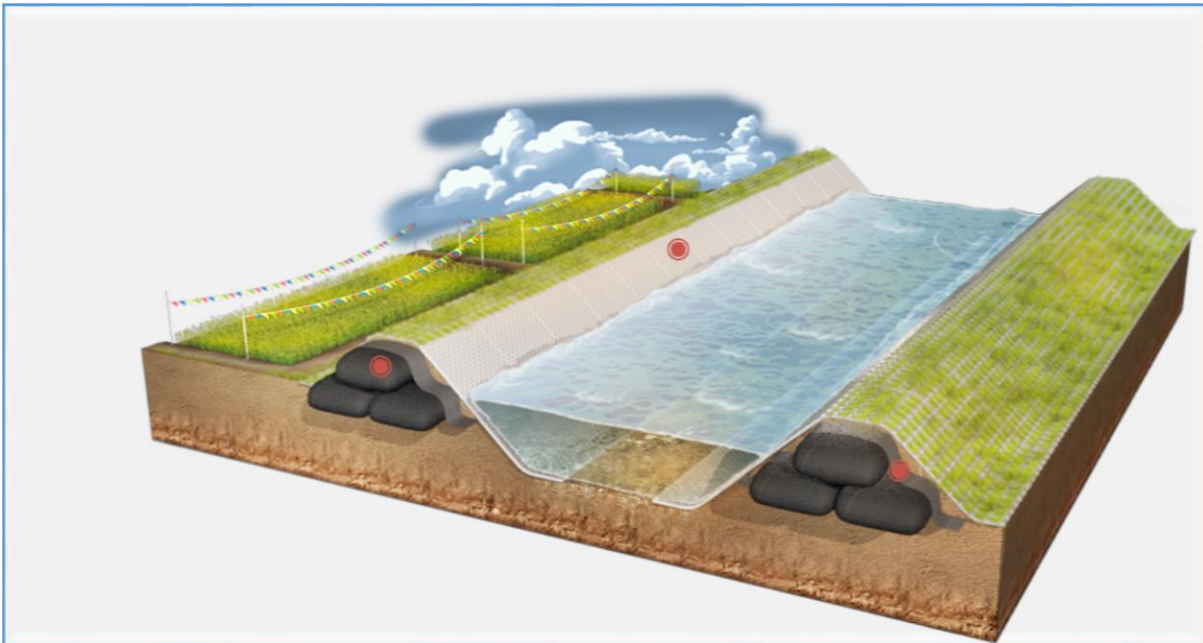
- Designate official parking zones and restore green spaces
- Install organized, fixed waste bins in controlled areas
- Reclaim and design the abandoned garden into a public space
- Improve drainage and water flow to reduce flood risk
- Add two small pedestrian bridges for safe crossing over risk zones
- Add trees, benches, and shaded areas to enhance walkability
- Create safe play zones for children where possible
- Enhance lighting and wayfinding for night-time safety
- Reserve space for future green infrastructure
- Convert the main commercial street Salam allikom into a pedestrian-only zone during the day, allowing limited vehicle access at night to reduce pollution, improve safety, and support local commerce in a more organized environment.



## **TARGETED URBAN INTERVENTIONS**

### **1. Managing Flood Risk: Levees Installation**

Levees act as barriers to prevent water overflow into urban areas



*image 8 Levees*

Photo by U.S. Army Corps of Engineers North Atlantic Division

### **2. Street Redesign**

#### **2.1. Walkable commercial road**

- Block car access during peak hours
- Add paving stones (e.g. permeable interlocking concrete pavers)
- Install bollards to limit cars.
- Use solar street lights with motion sensors.

#### **2.2. Sidewalks**

- Widen sidewalks to 1.8–2.2 m
- Paving with local sandstone or brick for better heat control.
- Add tactile paving for visually impaired.

#### **2.3. drainage**

- Add linear trench drains on both sides

- Use porous pavements in pedestrian areas

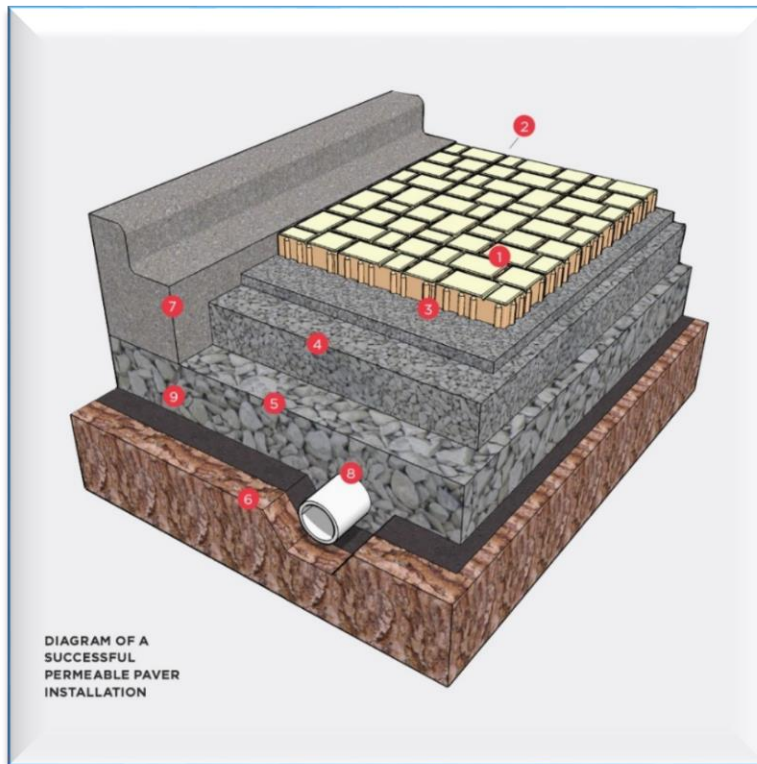


image 9 porous pavements

ref web <https://continuingeducation.bnppmedia.com/architect/courses/unilock/the-role-of-concrete-in-sustainable-design/2/>

### 3. Roadside Enhancements

#### 3.1. Street furniture types:

- Benches:



image 10 Benche

Material: thermally treated pine wood with galvanized steel frames ,Include backrests and armrests

- **Trash bins:**

Metal with perforated design for airflow



*image 11 bin*

- **Waiting areas**

- A wood-metal bench with a curved solar panel roof
- Solar energy system powering USB charging ports for phones and small devices
- Dual waste bins to support public cleanliness
- Designed for high-traffic pedestrian spots or bus stops
- Offers comfort, energy access, and visual enhancement of the area



### 3.2. Public Space Activation:

- Murals on blank walls:

Use themes of desert culture, water conservation, youth





### 3.3. Smart and Sustainable Systems of lighting:





- Solar LED street lights : Add pedestrian-level bollard lights near parks
- Typical spacing ranges:
  - Residential: 30–50 m
  - Collector/arterial: 30–45 m
  - Pedestrian paths: 10–20 m






image 12 Solar LED street lights

### 4. Type of trees:

NAME	CHARACTERISTICS	IMAGE
<b>Faidherbia albida</b>	Improves soil fertility -Long roots penetrate compact soil -Deciduous; provides winter sunlight and summer shade	

<p><b>Tamarix aphylla</b> (Athel tree)</p>	<ul style="list-style-type: none"> <li>-Salt-tolerant</li> <li>-Survives poor, stony soils</li> <li>-Used for windbreaks</li> </ul>	
<p><b>Acacia tortilis</b> (Umbrella acacia)</p>	<ul style="list-style-type: none"> <li>-Native to arid North Africa</li> <li>-Grows well in Hammada soil</li> <li>-Resistant to pests and drought</li> </ul>	
<p><b>Ziziphus spina-christi</b> (Sidr)</p>	<ul style="list-style-type: none"> <li>-High medicinal and ecological value</li> <li>-Grows in harsh, dry, poor soil</li> <li>-Long life</li> </ul>	
<p><b>Phoenix dactylifera</b> (Date palm)</p>	<ul style="list-style-type: none"> <li>-Deep roots handle compact soils</li> <li>-Fruit production possible with proper care</li> <li>-Minimal water needs once established</li> </ul>	

## 5. Shrubs

NAME	CHARACTERISTICS	IMAGE
<b>Atriplex halimus</b> (Saltbush)	-Excellent for degraded stony land -Minimal water, long life -Can be trimmed for landscape design	
<b>Lavandula dentata</b> (Desert lavender)	-Prefers compact, alkaline soils -Adds smell and color -Attracts pollinators	
<b>Rhus tripartita</b>	-Endemic to arid Algerian zones -Used in erosion control and soil stabilization	

- **Irrigation and planting strategy:**

- Irrigation will rely exclusively on drip systems to minimize water waste and ensure targeted delivery
- Soil preparation involves mixing the top 30–50 cm layer with sand and organic compost, applied specifically around planting holes to improve drainage and nutrient content

-Mulching with gravel will be used to stabilize soil temperature and retain moisture

- Plant spacing is set at 6–8 meters for large trees and 3–5 meters for shrubs, allowing healthy growth and long-term sustainability

## 6. TRANSFORMATION OF THE INTENDED PUBLIC GARDEN

The following comparative analysis highlights the transformation of a designated public garden space over time. The 1984 development plan clearly allocated this area as a green public garden intended to serve the surrounding neighborhood. However, field observations reveal a complete deviation from the original purpose. The site has become an unmanaged and polluted dumping ground, lacking aesthetic value. This intervention proposes to restore the space to its intended role by reintroducing organized landscaping, public seating, proper waste management, and sustainable design elements. The visual comparison below includes the original plan, the current degraded state, and the proposed design to emphasize the need for rehabilitation.

**The suggested plan**

**2025**

**1994**







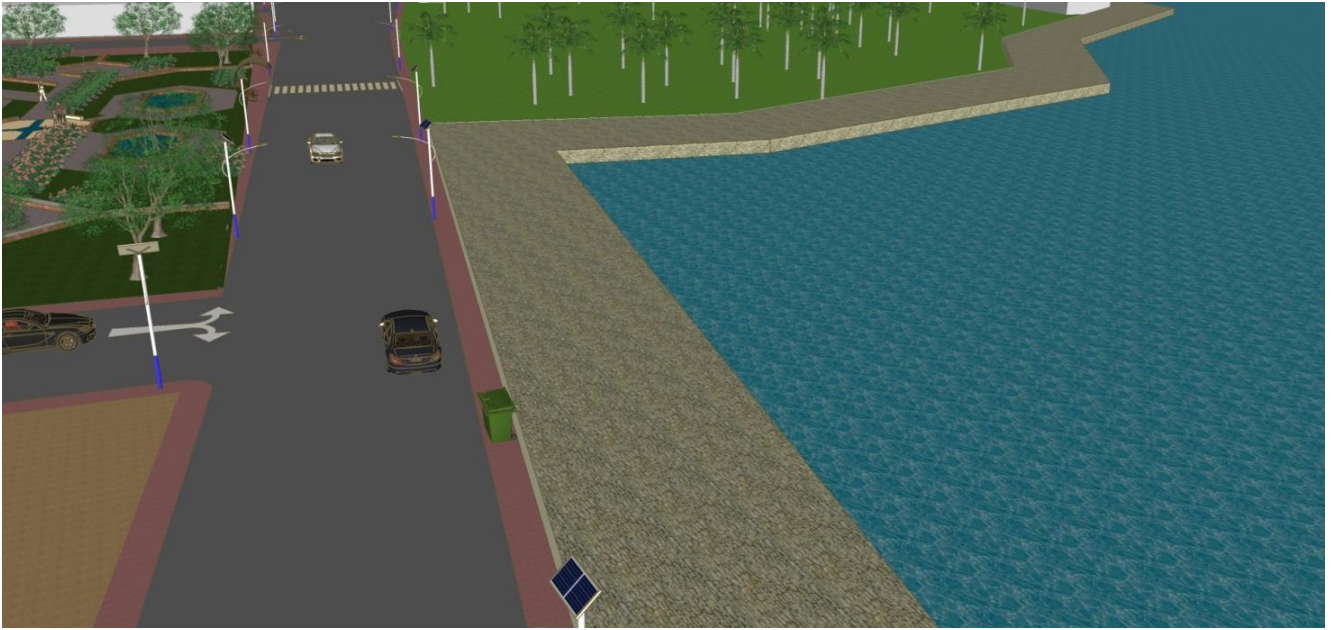


# SALAM ALIKOM ROAD



## Other interventions





## **Conclusion:**

This study examined the urban challenges of Ksabi – Chilif in the city of Tindouf, with a focus on mobility, public space, and environmental risks. Through field observations, spatial analysis, and reference to legal and planning frameworks, the research identified critical issues and proposed practical interventions based on sustainable urban planning principles.

The neighborhood suffers from several constraints despite having basic infrastructure. Road degradation, scattered informal parking, insufficient green areas, and a general lack of functional public spaces reduce both mobility and quality of life. Environmental concerns, particularly flood risk and pollution, further limit the neighborhood's development potential.

The research proposes urban restructuring that prioritize both human needs and ecological considerations. Pedestrianizing the main commercial axis can reduce vehicle dominance and improve air quality. Converting underused parcels into green spaces and shaded communal areas can enhance social interaction and thermal comfort. Designating formal parking zones at strategic points around the area improves both mobility and environmental management. Flood mitigation strategies such as permeable paving, bioswales, and improved drainage are essential to reduce disaster risk and support long-term resilience.

The application of SketchUp allowed for a clear visualization of proposed interventions and their integration within the existing urban fabric. The approach followed Algerian regulatory texts and aligned with UN-Habitat guidelines for inclusive and sustainable cities.

This thesis contributes to the urban planning field in Algeria by addressing a previously unstudied area and demonstrating how localized, sustainable, and technology-supported planning can respond to current urban needs. The proposed

model can serve as a reference for other neighborhoods facing similar spatial and environmental challenges.

## **thesis abstract**

Urban planning is the discipline concerned with organizing and managing land use to ensure sustainable, functional, and liveable urban environments.

This research focuses on the land occupancy plan 3 QSabi-Chlif neighbourhood in the city of Tindouf, Algeria.

The choice of Tindouf stems from the absence of prior urban planning studies in the area, despite rapid urban expansion.

QSabi was selected due to its evident environmental degradation and disorganized urban growth.

The main problem identified is the lack of structured urban planning, resulting in poor road conditions, limited green spaces, environmental pollution, and unregulated parking and flood risk.

The existence of these issues was confirmed through field surveys, photographic documentation, analysis of satellite images, and official municipal data.

The proposed interventions include :

- Creating green spaces
- Converting the main commercial road into a pedestrian-only zone
- relocating solid waste depot to reduce pollution
- rehabilitating the road network
- Reducing environmental risks, including flood exposure

The proposals are grounded in Algerian urban planning regulations and UN-Habitat urban development principles.

This study provides the first structured urban intervention proposal for this neighbourhood and highlights a replicable approach for similar underserved urban areas.

## ملخص

يُعنى التخطيط الحضري بتنظيم استخدامات الأراضي لضمان بيئة حضرية مستدامة، وظيفية، وصالحة للعيش.

تتناول هذه الدراسة مخطط شغل الاراضي 3-حي قصابي شلف بمدينة تندوف في الجزائر وتم اختيار مدينة تندوف لغياب الدراسات التخطيطية السابقة رغم توسعها العمراني، واختير فكان بسبب مظاهر التدهور البيئي الواضحة فيه، وتوسع عمراني غير منظم يزيد من حدة الفيضانات ويهدد جودة البيئة الحضرية

تكمن المشكلة الرئيسية في غياب تخطيط حضري منظم، مما أدى إلى تدهور حالة الطرق، ندرة المساحات الخضراء، التلوث البيئي، وفوضى مواقف السيارات العشوائية و تواجد حظيرة ولائية في مركز المدينة.

تم التحقق من هذه المشاكل من خلال العمل الميداني، التوثيق الفوتوغرافي، تحليل الصور الفضائية، والبيانات الرسمية للبلدية , كما تشمل التدخلات المقترحة:

- إنشاء مساحات خضراء
- تحويل الطريق التجاري الرئيسي إلى منطقة للمشاة فقط
- نقل الحظيرة الوطنية لتقليل التلوث و تحويلها الى حديقة
- إعادة تأهيل شبكة الطرق
- الحد من المخاطر البيئية، خاصة الفيضانات

استندت المقترحات إلى القوانين الجزائرية الخاصة بالتخطيط الحضري ومبادئ تخطيط المدن التابع للأمم المتحدة.

تقدم هذه الدراسة أول تصور تخطيطي مهيكّل لهذا الحي، وتفتح المجال لتطبيق النموذج في مناطق حضرية مشابهة.

## Résumé

L'urbanisme est une discipline qui vise à organiser l'utilisation du sol afin d'assurer un environnement urbain durable, fonctionnel et habitable.

Cette étude porte sur le Plan d'Occupation des Sols n°3, quartier Kasabi-Chlef, situé dans la ville de Tindouf, en Algérie. Le choix de Tindouf s'explique par l'absence d'études urbanistiques antérieures malgré une expansion urbaine rapide. Le quartier a été sélectionné en raison d'une dégradation environnementale visible et d'un développement non planifié qui aggrave les risques d'inondation et compromet la qualité de l'environnement urbain.

Le principal problème identifié est l'absence de planification urbaine structurée, entraînant la dégradation du réseau routier, le manque d'espaces verts, une pollution environnementale marquée, un stationnement anarchique, ainsi que la présence d'un parc provincial au centre-ville.

Ces constats ont été confirmés à travers un travail de terrain, une documentation photographique, l'analyse d'images satellites et des données officielles de la commune.

Les interventions proposées comprennent :

- La création d'espaces verts
- La transformation de la voie commerciale principale en zone piétonne
- Le déplacement du parc provincial hors du centre et sa reconversion en espace vert
- La réhabilitation du réseau routier
- La réduction des risques environnementaux, notamment les inondations

Les propositions s'appuient sur la législation algérienne en matière d'urbanisme et sur les principes du programme ONU-Habitat.

Cette étude constitue la première proposition d'aménagement structurée pour ce quartier et offre une méthodologie reproductible dans d'autres contextes urbains similaires.