Modernizing the Survey Mark Infrastructure in NCD

A Pilot Project for a NCDSDI

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ASPNG 50th Survey Congress

2016

Introduction

- Survey Mark Infrastructure
- PNG94: Static to Semi-dynamic system
- Standard Data Infrastructure

Striking up a conversation

- “Are the current plans adequate?
- Which areas require priority and by how much?
- Can the existing infrastructure & services competently accommodate current demands and improve seamlessly to meet future challenges?

Objectives

1. Highlight issues of the static PNG94 datum that needs upgrading to a semi-dynamic system

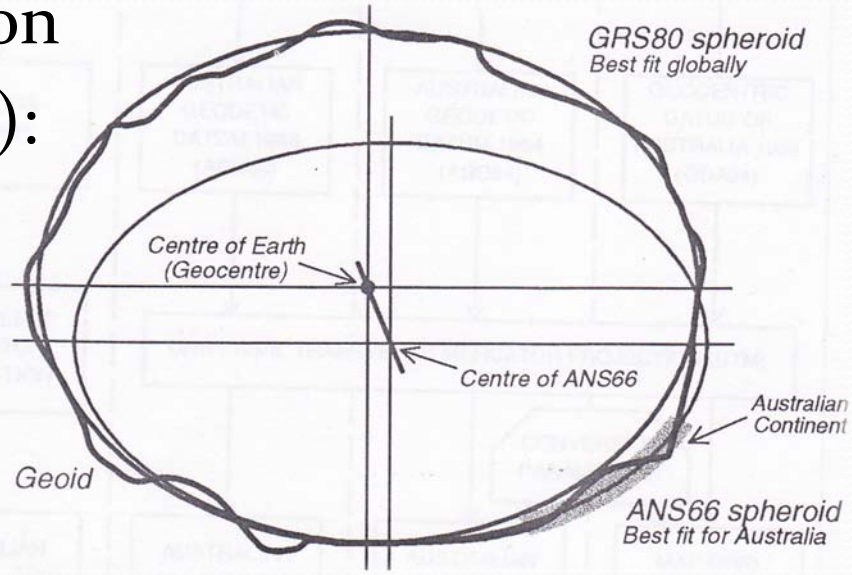
2. Standardizing the SMI and integrating with various statutory thematic data

3. Establish s standardized SDI for data sharing & cooperation

4. Metadata documentation of the thematic spatial data

PNG94 datum

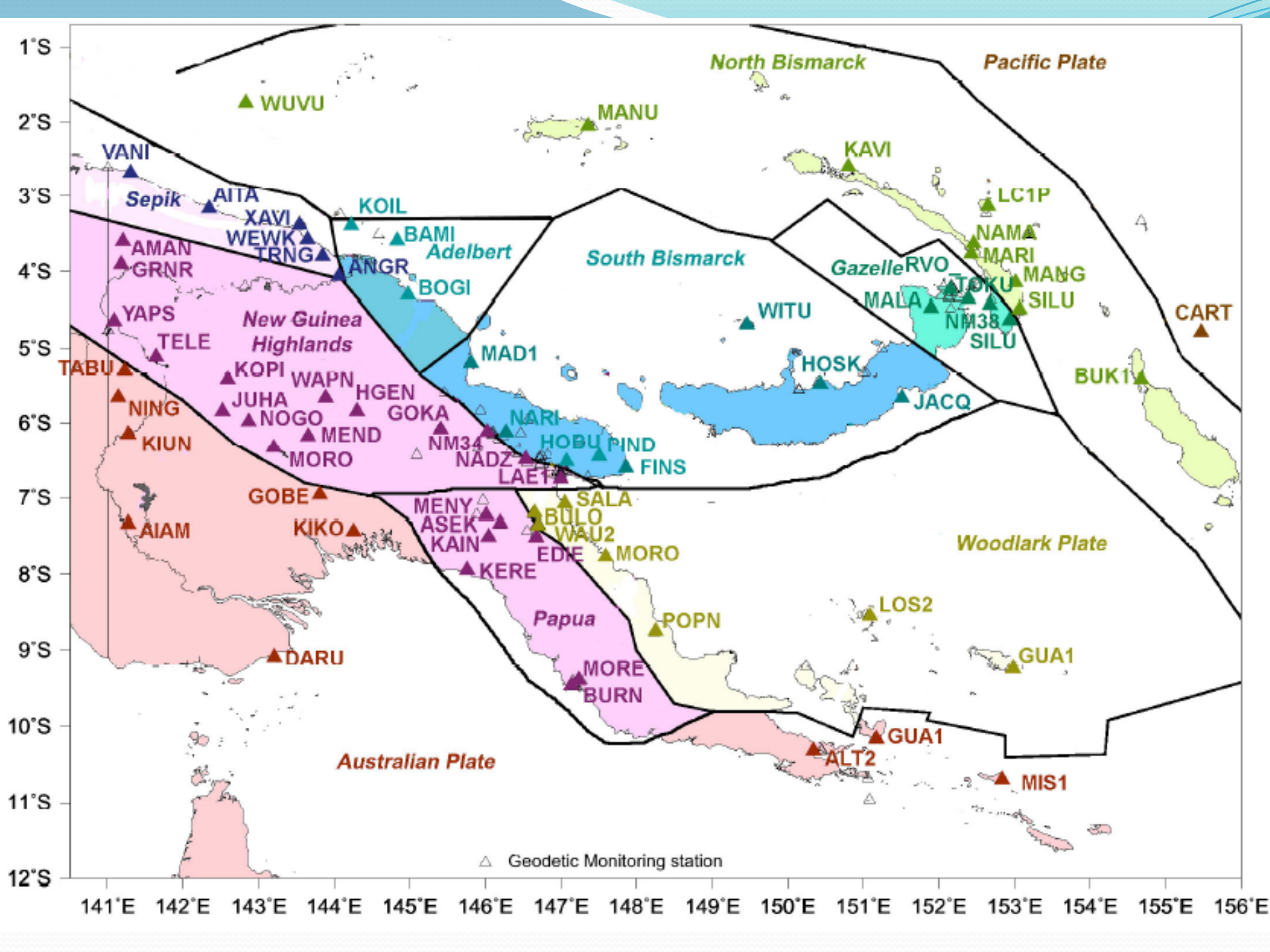
- Realized in 1994 and gazetted in 1996
- Earth-centered datum (GPS enabled)
- PNGMG94 ~ UTM Projection
- Ellipsoid definition (GRS80):
  - ~ a = 6,378,137m
  - ~ 1/f = 298.257222101



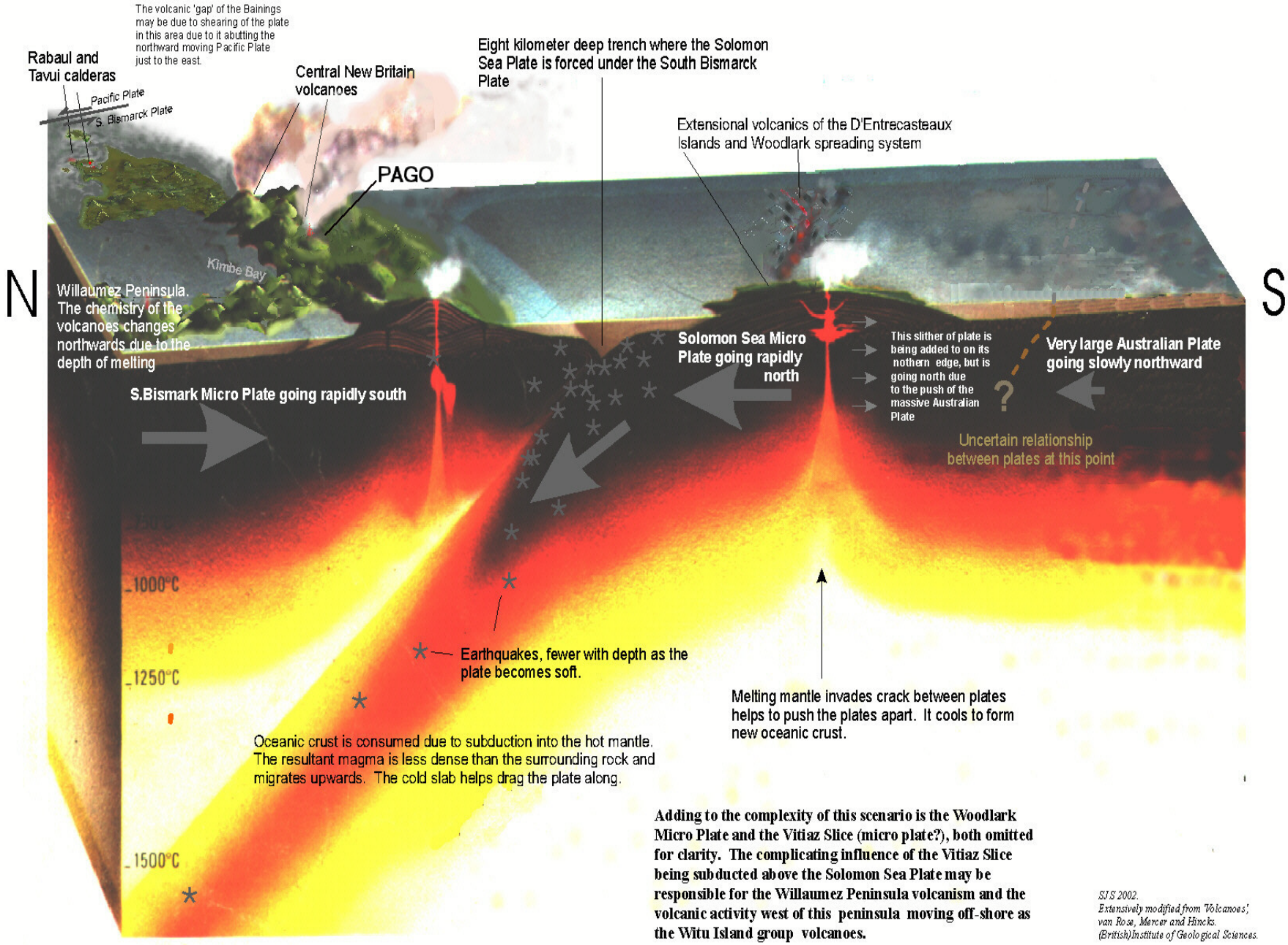
ANS:
~ a = 6,378,160
~ 1/f = 298.25

GRS80:
~ a = 6,378,137
~ 1/f = 298.2572221

WGS84:
~ a = 6,378,137
~ 1/f = 298.2572236

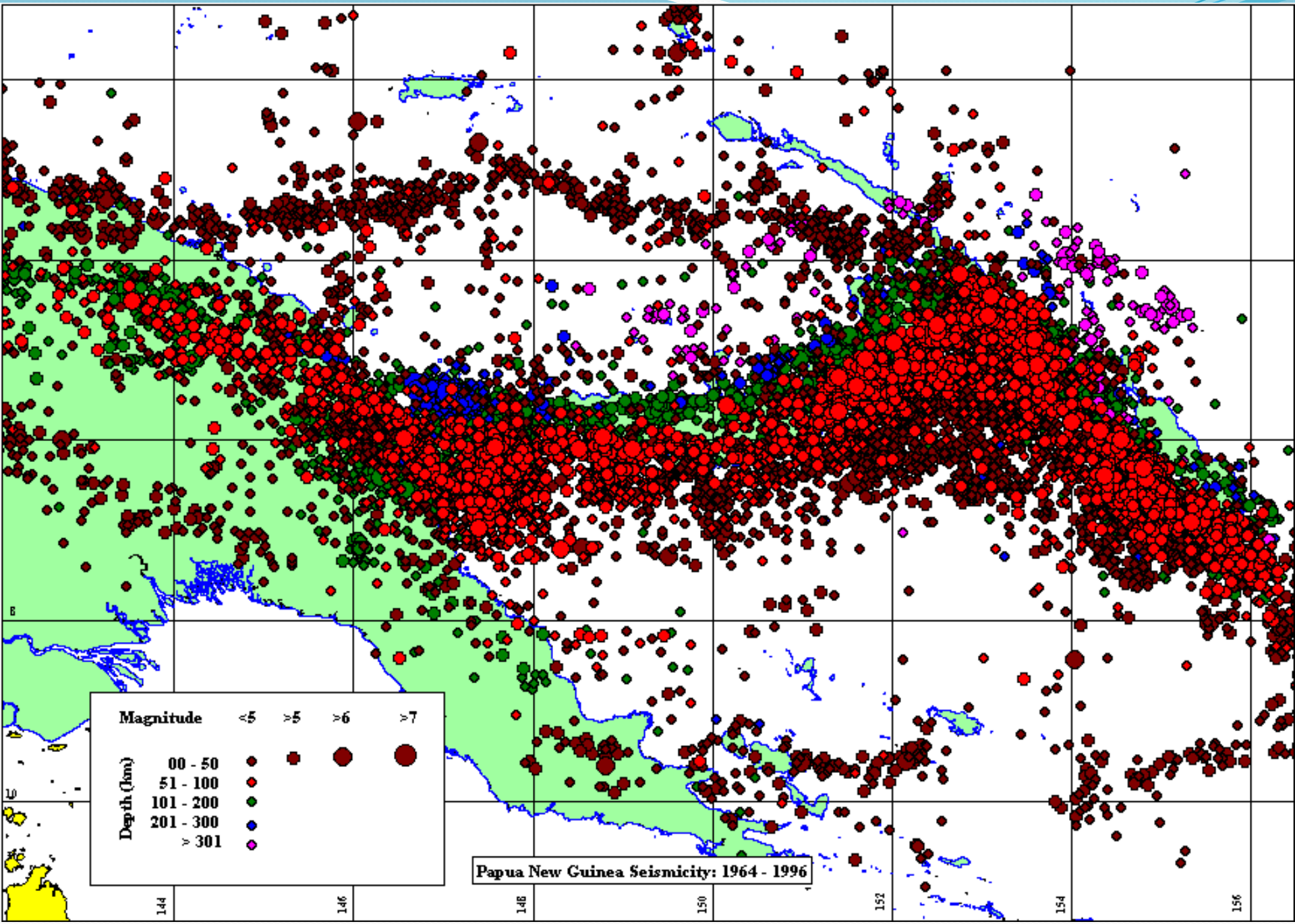

North Bismarck
Pacific Plate
South Bismarck
Adelbert
Sepik
New Guinea Highlands
Gazelle
Woodlark Plate
Papua
Australian Plate
WUVU
MANU
KAVI
VANI
AITA
XAVI
WEWK
TRNG
KOIL
BAMI
ANGR
BOGI
AMAN
GRNR
YAPS
TELE
TABU
KOPI
WAPN
HGEN
JUHA
NOGO
MEND
MORO
NING
KIUN
GOKA
NM34
NADZ
LAE1
NARI
HOBU
PIND
FINS
MAD1
WITU
HOSK
JACQ
LC1P
NAMA
MARI
RVO
TOKU
MANG
MALA
SILU
NM38
CART
BUK1
GOBE
AIAM
KIKO
MENY
ASEK
KAIN
EDIE
KERE
SALA
BULO
WAU2
MORO
POPN
LOS2
GUA1
DARU
MORE
BURN
GUA1
ALT2
MIS1
Geodetic Monitoring station
1°S
2°S
3°S
4°S
5°S
6°S
7°S
8°S
9°S
10°S
11°S
12°S
141°E
142°E
143°E
144°E
145°E
146°E
147°E
148°E
149°E
150°E
151°E
152°E
153°E
154°E
155°E
156°E

Cartoon of Central and East New Britain and the Solomon Sea's complex and poorly understood tectonic layout (not to any scale)

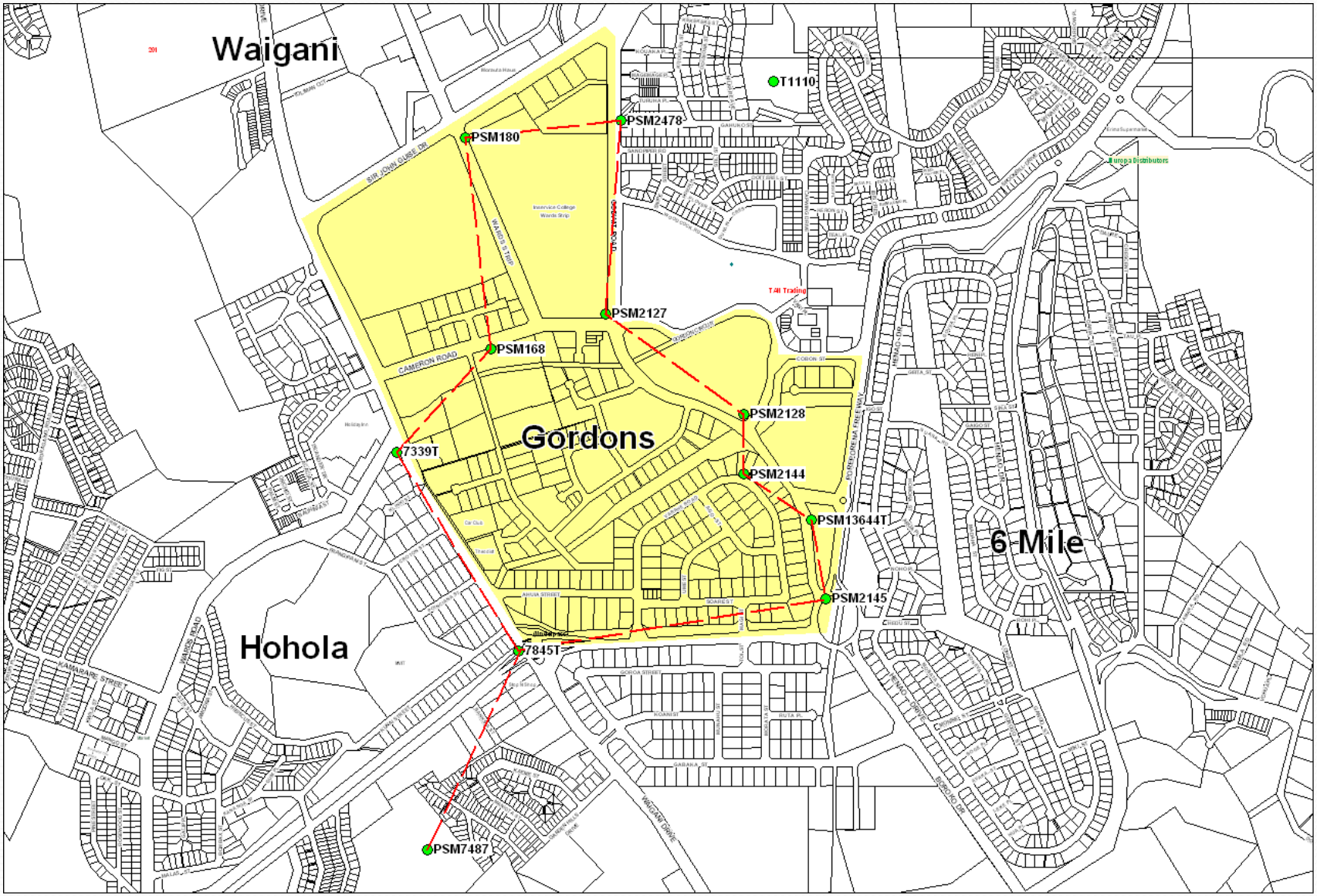


Adding to the complexity of this scenario is the Woodlark Micro Plate and the Vitiaz Slice (micro plate?), both omitted for clarity. The complicating influence of the Vitiaz Slice being subducted above the Solomon Sea Plate may be responsible for the Willaumez Peninsula volcanism and the volcanic activity west of this peninsula moving off-shore as the Witu Island group volcanoes.

SJS 2002.
Extensively modified from 'Volcanoes', van Rose, Mercer and Hincks. (British) Institute of Geological Sciences.


Magnitude
≤5
>5
>6
>7
Depth (km)
00 - 50
51 - 100
101 - 200
201 - 300
> 301
Papua New Guinea Seismicity: 1964 - 1996
144
146
148
150
152
154
156

Study Area – pilot project

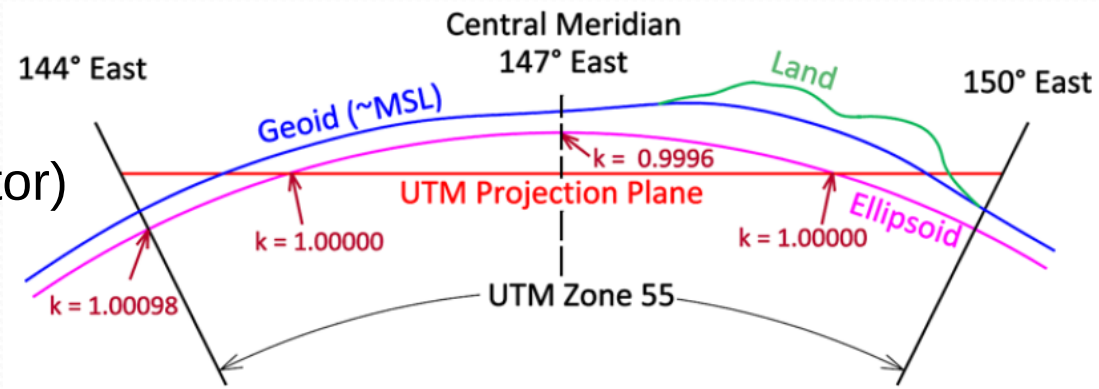


Existing SMI Records

- Cadastral Plans:
  - Datum (Paga, AGD66, WGS72, WGS84, PNG94)
  - Azimuths (Grid, True, FSM, Paga)
  - Distances (Grid, ground / metric, imperial)
- PSM sketches – not complete / missing info
- Standardize SMI data to PNG94 Datum
  - Maintain accuracy and enable integration with utility spatial data and other thematic databases

Transformation Parameters

1. Datum:
   - GRS 80 (Geodetic Reference System 1980)
     - ➢ PNG94 / PNGMG94 (UTM projection)
   - WGS 84 (World Geodetic System 1984)
   - ANS (Australian National Spheroid)
     - ➢ AGD66
   - PAGA (Local Datum)
2. Projection:
   - TM (Transverse Mercator)
3. Azimuth:
   - Paga Grid / True North
   - Grid North
4. Scale:
   - Imperial / metric



Transformation to PNG94

- 11 control stations saturated over area of >180 ha.
- Transformed coords Lat/Long (AGD66) to E/N (AMG66)
- Calculated grid bearing/distance from E/N (AMG66) coords
- Based on 7487T (Hohola Hill) with PNGMG coords, applied grid brg/dist
  - Paga to Grid (PNGMG94)
    - Bearing + 0° 01' 30"
    - Distances × 0.999597 (combined factor)
- Accuracy (misclose - average) ~ 0.5 metres

Problem

- Fragmentation (discontinuity)
  - Inconsistent standards, e.g. datum
    - ADG66, WGS72, WGS84, PNG94
  - Inconsistent resolutions
    - level of detail
  - Currency (up-to-date)
    - Cyclic revisions due to nature of data
- Duplication of data, efforts, costs
- Agreements (formal/informal)
  - Ad-hoc / in a ‘state of flux’

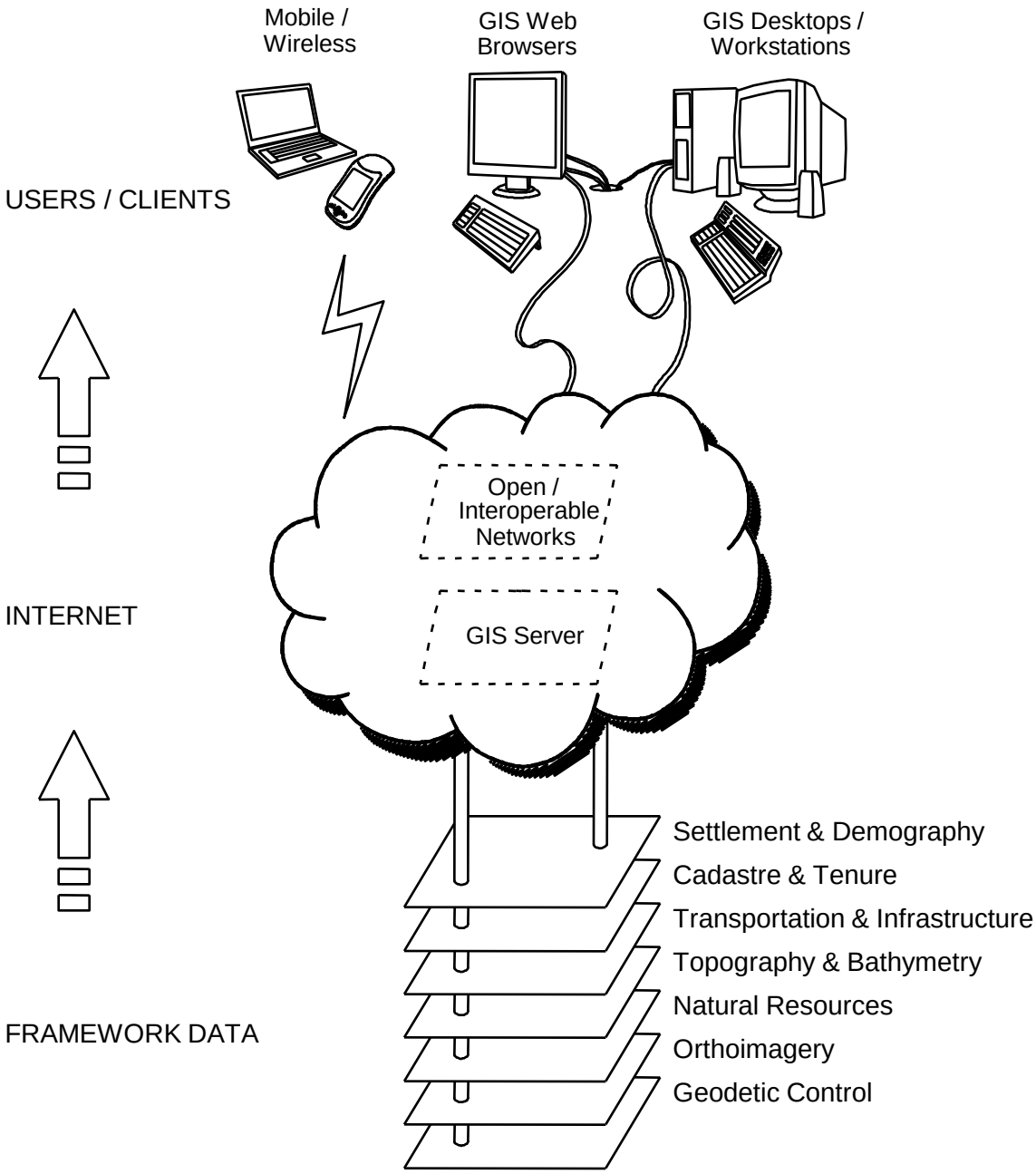
Spatial Data Infrastructure

What does it stand for?

1. A collaborative effort to create a common source of basic geographic data

2. Procedures & technology for building & using the data

3. Institutional relationships & business practices that support the environment


Mobile / Wireless
GIS Web Browsers
GIS Desktops / Workstations
USERS / CLIENTS
Open / Interoperable Networks
GIS Server
INTERNET
Settlement & Demography
Cadastre & Tenure
Transportation & Infrastructure
Topography & Bathymetry
Natural Resources
Orthoimagery
Geodetic Control
FRAMEWORK DATA

Spatial Data Industry

- Increased growth of spatial data in PNG
- Spatial data account for large volume of economic activity
- Proliferation of spatial data due to modern technology

Benefits of Data Standards

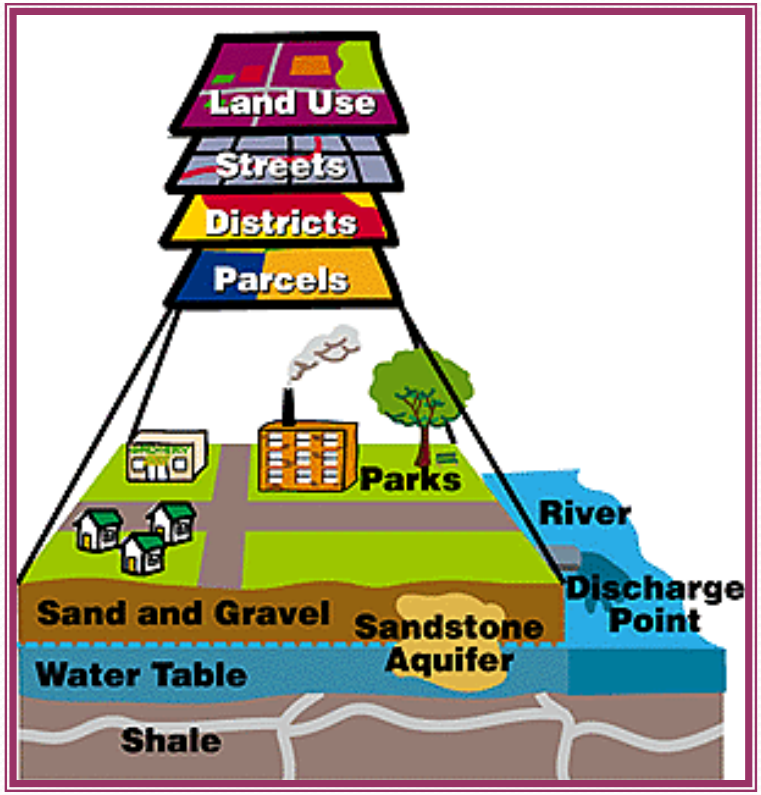
- Increased data sharing
- Improved data consistency
- Increased data integration / interoperability
- Better understanding of data
- Improved documentation of info resources
- Improved control over data updates, etc
- Improved security

NCD Spatial Data Infrastructure

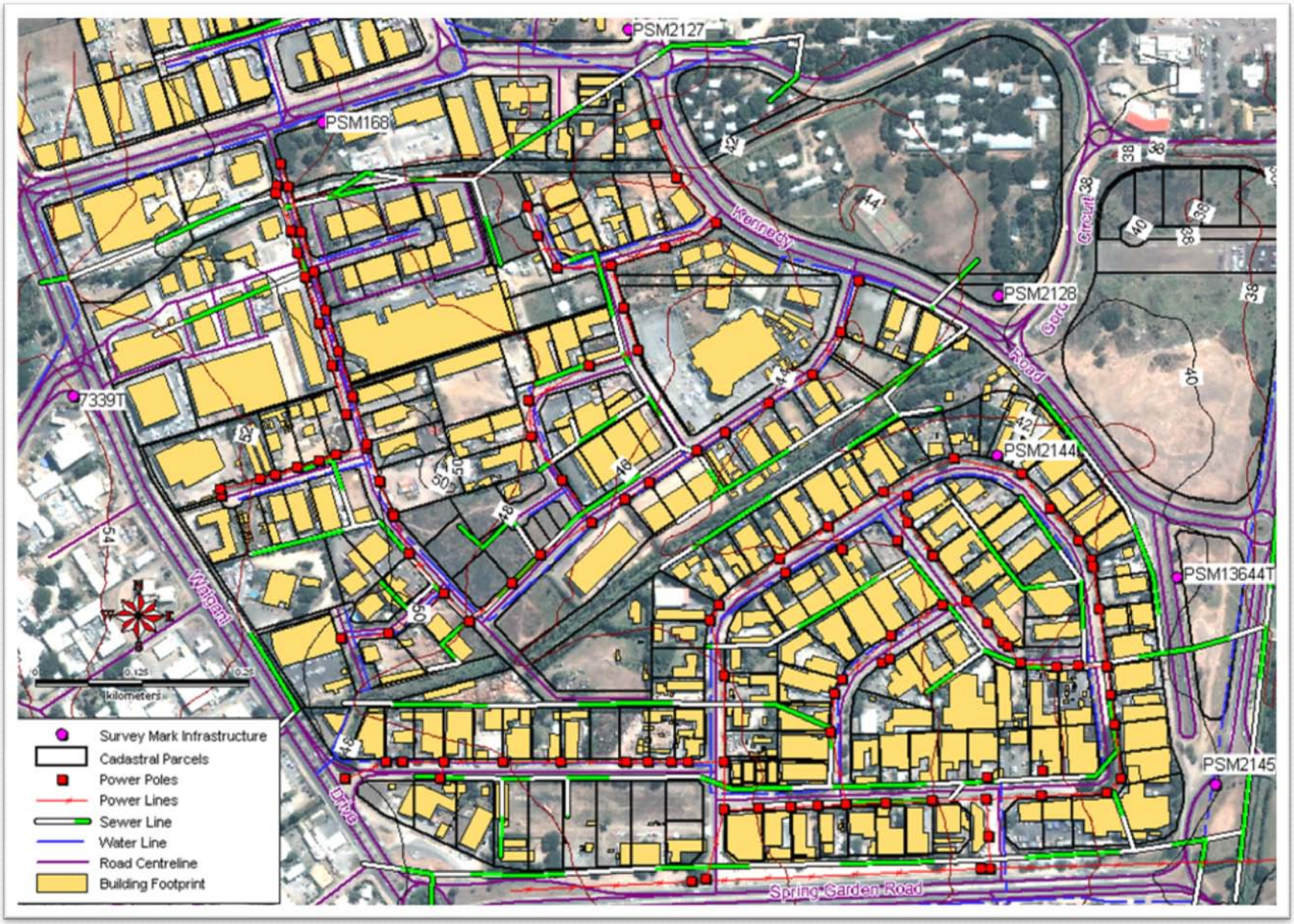
"Cross Agency Data Sharing"

Public Utilities & Facilities:

- Parcels / Zoning
- Roads / Drainage
- Water / Sanitation
- Communication
- Electricity
- Buildings
- Land use



Demonstration of NCDSDI



Metadata Support

- Data about data
- Documentation of spatial data – a necessity
- Provide users a quick summary of nature and content of the data
  - Data understood by users
  - Enables wide dissemination to society

Applications

DLPP:

- Identify illegal occupation of properties & lost revenue
- Identify properties with inconsistent land rental payments

Others:

- Identify illegal use of public property (electricity, water, etc.)
- Emergencies (fire, flooding, etc.)
- Building codes
- Road safety

Conclusions

- Lack of standard datum and consistency in the Survey Mark Infrastructure
- Spatial (or positional) accuracy is more improved compared to digitized format
- Spatial data shared by different organizations based on one standard in the form of a SDI

Recommendations

- Migration of SMI data to PNG94 datum
- Upgrade the 1991 Survey Directions to reflect current circumstances and guide future economic developments
- Upgrade and transform the static PNG94 datum to a semi-dynamic system
- DLPP to establish a taskforce to investigate and set up guidelines for the establishment of a collaboration framework for the NCDSDI