



## **GPS Survey NAM Waddenzee**

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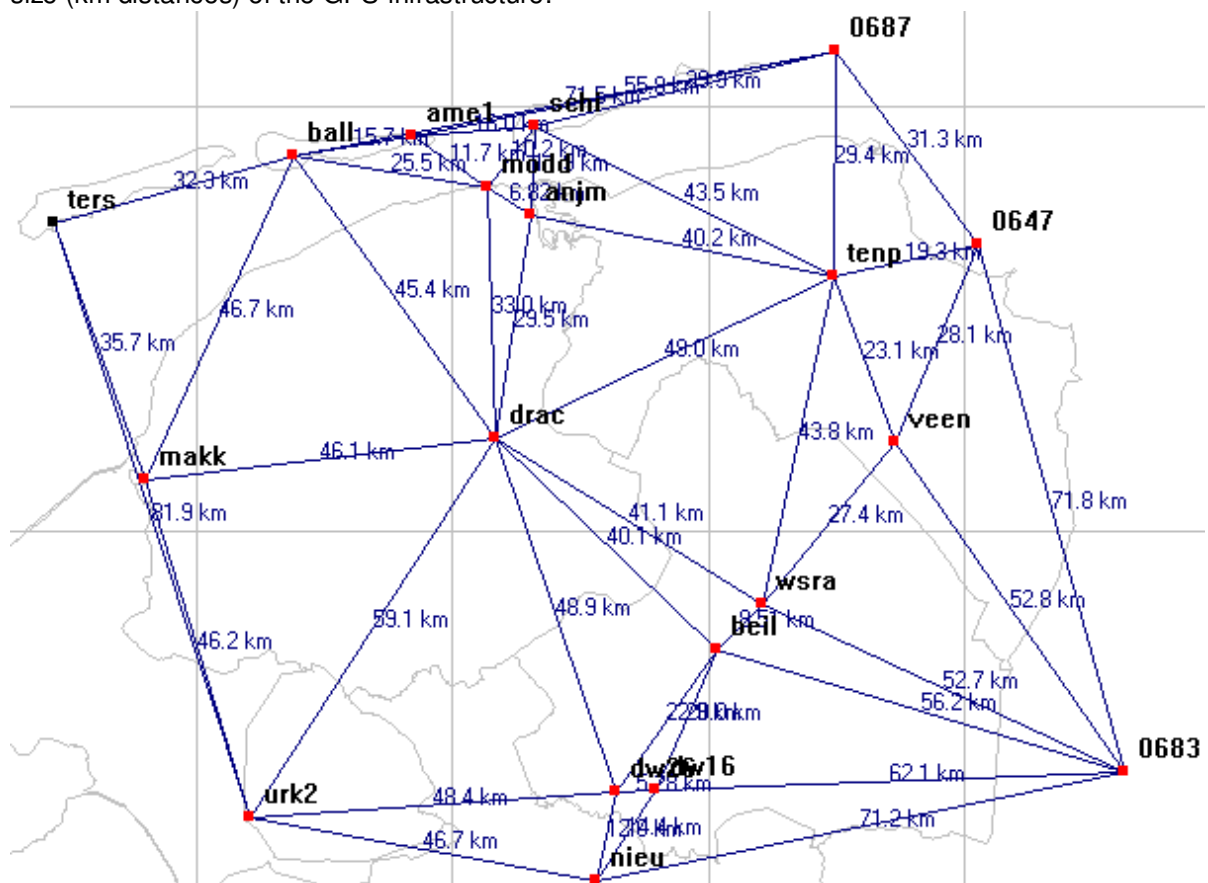
## 1 Introduction

06-GPS has been assigned by SHELL / NAM to assist with a GPS survey and its processing for determining exact elevations of underground benchmarks in and around the Waddenzee. These surveys are expected to deliver elevations / heights with mm-accuracies. This report describes in short the activities as performed by 06-GPS concerning the preparations and actual GPS surveys. The main part however will describe the methods of how to process the GPS data to get the highest accuracy possible.

## 2 Preparation

For the positioning of the underground benchmarks in and around the Waddenzee it was necessary to use the technique of GPS post processing. This is a method of processing gathered GPS observations from both GPS reference stations (exactly known in position) as well as GPS observations from unknown points together to obtain relative but highly accurate positions for the unknown points. The use of fixed GPS receivers and antennas on well-known points does not only make the results fit in the local coordinate system, but also creates conditions for determining and eliminating all the error sources that influence the quality of GPS positioning.

In total 12 reference stations and 7 continuous monitor stations are in use by the end of 2013. See the figure below and appendix I for a coordinate list of all stations. For an optimal fit within the Dutch geometrical infrastructure, the AGRS stations Terschelling and Westerbork are included in the network computations. The monitor stations near the Waddenzee, 'Ameland-East' (ame1), 'Anjum' (anjm) and 'Moddergat' (modd), are operational since 2006. This figure gives an impression of the situation and size (km-distances) of the GPS-infrastructure:



For all permanent stations as for the mobile GPS masts the same equipment is chosen. On all locations except for the AGRS-stations and Borkum a combination of a Topcon GB-1000 and a Topcon CR-3 choke ring antenna is used. All antennas are also individually calibrated so that their receiving characteristics are exactly known. Especially for an accurate determination of elevations/height it is necessary to have exact knowledge of the phase center variations of the antennas. A simple comparison between individual antenna models shows that differences of 1 to 2 mm's exist between individual antennas.

Photos of the reference antennas placed in May, 2006 on respectively Schiermonnikoog and AME-1:



Photo of the reference antenna placed in December, 2006 nearby Moddergat:



All GPS reference antennas are also surveyed relatively to several nearby height benchmarks by means of leveling, to be able to detect (unsuspected) local deformation of the antennas.

### 3 Post-processing technique

For the GPS-processing “raw” observations per stations are collected with an interval of 15 seconds. The permanent stations have gathered data since May, 2006, while all mobile stations only collect observations for a typical 5 days per point.

Storing observations of the permanent stations is done in two different ways to minimize the risk of losing data. Except for the governmental AGRS-stations all reference stations are connected to the 06-GPS control center in Sliedrecht 24 hours per day either using KPN Managed VPN or a Shell VPN-connection to the stations of Anjum and East Ameland. Data is stored in the general used RINEX format (Receiver INdependent EXchange format). Next to the central RINEX storage all data is also stored on the internal Flash Memory card of the Topcon GPS receivers in a so called TPS-format (Topcon Positioning Systems). This TPS data serves as a backup in case of communication interruptions between Sliedrecht and one of the reference stations. Before the final processing all data has to be converted to the RINEX format. In these RINEX files phase- code- and Doppler observations are stored for both GPS frequencies L1 and L2 as well as Signal to Noise Ratios.

For the final post-processing NAM has chosen to use the GNSMART software of the Geo++ GmbH company from Hannover, Germany. GNSMART stands for “GNSS State Monitoring and Representation Technique”. In the year 2005 positive tests were realized with this software package at the Anjum site where deliberate lowering of the GPS-antenna could be detected at the mm-level within a few days of observation time.

The Geo++ software is able to deliver a highly accurate result for the combination of fixed, dynamic (Anjum, AME-1 and Moddergat) and unknown Waddenzee stations in one single processing with optimal use of antenna calibration models and modeling of all error sources involved with GPS surveying. Next to that it is able to deliver cross correlations between all individual stations making it a surveying tool comparable to optic leveling.

#### GNSMART

(This text has been copied from Geo++ documents).

Geo++@ has developed the system GNPOM (Geodetic Navstar - Permanent Object Monitoring) to overcome the general restrictions using real time GNSS techniques. GNPOM is based on the multi-station real-time software GNNET, which is able to process the carrier phase observations of multiple receivers simultaneously. The result is not a set of single baselines, but a homogeneous set of coordinates with a realistic variance-covariance estimation for all stations.

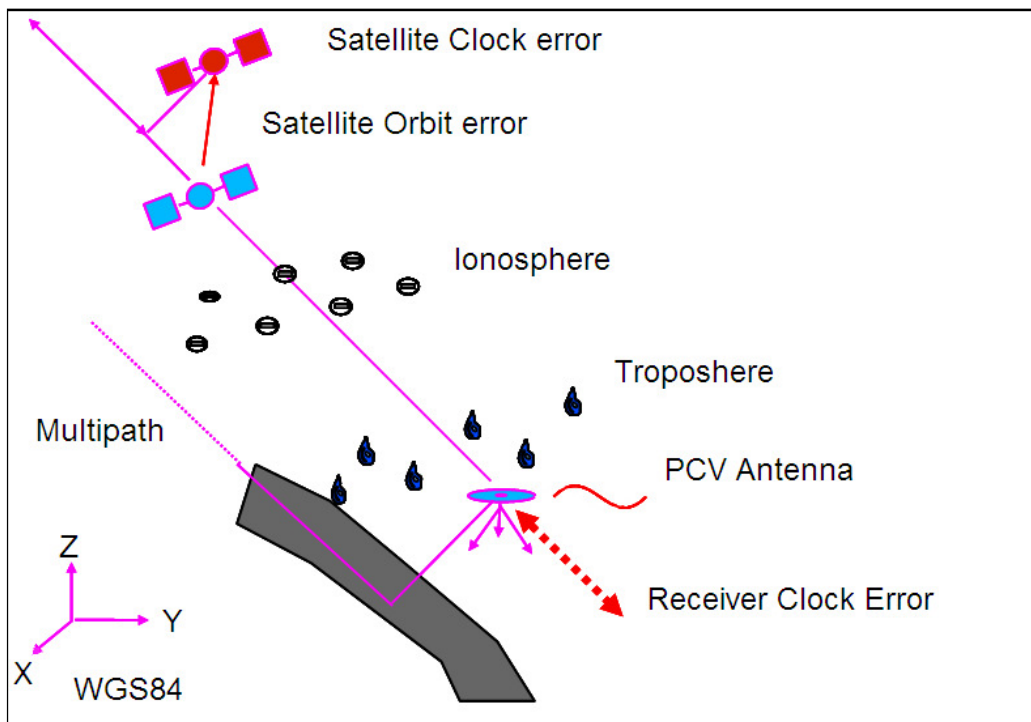
For the processing the Software Package Geo++ GNSMART is used. GNSS-SMART stands for **State Monitoring And Representation Technique** describing the essential concept, while GNSMART is the actual Geo++ software implementation of this technique. The GNSS errors must be precisely modeled and monitored to resolve phase ambiguities as a **primary task**. For any time and location within the covered network area sophisticated services must provide information on the GNSS errors based on the state monitoring. The methods for this **secondary task** are generally termed “representation technique”. This secondary task meets the requirements for the Waddenzee stations in and around the Waddenzee. In GNPOM the primary and secondary task can be done in one process, because all stations (reference and object station) are available at the central computer where GNSMART is running. As part of Geo++ GNSMART the program module GNNET enables a high precision GNSS multi-station processing. Normally GNNET processes the carrier phase measurements from single or dual frequency GPS and (optionally) GLONASS receivers in real time. Generally, the observations are provided by other program modules, for example reference station modules GNRT or GNREF. Thus, measurements from directly or indirectly accessible GNSS receivers or derived observations, e.g. RTCM correction, data can be processed. Depending on the individual application, GNNET can determine coordinates and/or system parameters such as atmospheric errors or orbit errors. The data set is based on RINEX observation. Therefore GNNET is run in post processing mode.

## Consideration of GNSS errors

The modeling approach of GNSS is an important aspect. A complete state space model (SSM) with millimeter-accuracy is implemented for the rigorous and simultaneous adjustment of GNSS observables, which is essential for the **primary task**. The state space modeling follows the idea to model the actual error sources instead of handling the effects of the errors. The error effects belong to the observation space, while the error sources are associated with the state space. All error sources build up the state space model (SSM). To determine the (error) state of a GNSS system, GNSMART estimates the following state parameters:

- satellite clock synchronization error
- satellite signal delays (group delays)
- satellite orbit error (kinematic orbits)
- ionospheric signal propagation changes
- tropospheric signal delays
- receiver multipath (optional)
- carrier phase ambiguities
- receiver coordinates (optional)
- receiver clock synchronization error
- receiver signal delays (group delays)

The next picture is a simplified illustration of the main error sources and their influence on the distance measurements from receiver to satellite:



The state space modeling of GNSMART applies beforehand corrections to the GNSS observations.



The SSM model is prepared for the following corrections:

- satellite-receiver phase wind-up effect (satellite attitude)
- (absolute) satellite antenna PCV correction
- site displacement effect (solid earth tide, pole tide, ocean loading, atmospheric loading, local displacement)
- relativistic corrections
- higher order ionospheric correction
- (absolute) receiver antenna PCV correction

The extension of the network defines the significance of the corrections and consequently the quality of the state space modeling. In smaller networks, like the present six station network, some corrections can be neglected. Therefore GNSMART currently does not correct for loading effects and higher order ionosphere. The adjustment model is a Kalman filter for real time applications. The Kalman filter is proved to be well suited for state estimation and monitoring tasks. The actual adjustment is a simultaneous adjustment of all L1 and L2 observations. Advantages of simultaneous L1/L2 adjustment are:

- rigorous modeling of correlations between linear combinations
- rigorous modeling of common parameters like L1-L2 delays for satellite and receiver
- improvement of noise level for derived state parameters

The separation and modeling of individual GNSS error components is straight forward using un-differenced or also termed non-differenced observations. The use of non-differenced observations is a key issue in ambiguity resolution, optimized modeling and processing in GNSMART. The advantages of non-differenced modeling and ambiguities are:

- network operates in absolute mode
- no mathematical correlation between observations
- robustness against failures of single reference stations
- optimal reliability

The use of differenced observations (i.e. double difference observable) and accordingly the use of baselines/triangles between reference stations is a limitation and a loss of information compared to the non-differenced approach. Information on the GNSS errors can be best obtained from the rigorous adjustment of multiple reference stations with sufficient redundancy and network size.

### Consideration of station dependent errors

Multipath (MP) is the most limiting factor for very precise positioning applications with GNSS. Several MP mitigation techniques are known and implemented in many receiver types. However, these techniques normally only attack the code MP effects. MP errors in carrier phase measurements are much more complicated to be mitigated through signal tracking techniques. All GPS receivers from Topcon use the AMR (Advanced Multipath Mitigation) technique for both code and phase observations. Also all antennas have been chosen to be choke ring antennas which are much less receptive for multipath than normal, light rover antennas.

Geodetic and precise GPS measurements make the exact knowledge of the reception characteristics of the used antennas and therefore a calibration necessary. Intensive use of such characteristic have been made in the development of the absolute antenna calibration method. All used antennas in this project are individually calibrated.

The screenshot displays the Geo++ GNSS Multistation RT Network Solution NAM2 software interface. On the left, a vertical list of station identifiers is visible, including c035, c065, d050, d056, d065, d068, d107, d110, pa1, pa2, pa4, 2686, 2689, 269, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000. The main window contains two overlapping dialog boxes. The 'Station Dynamics' dialog is in the foreground, showing settings for receiver 'c035'. It includes checkboxes for 'External (Static/Kinematic)', 'Forced', 'Static', 'Kinematic', 'Dynamic', and 'Periodic Coordinate Output'. The 'Ref Check' dialog is also visible, showing coordinates for station 'c035' and a reference check table. The status bar at the bottom shows 'WN: 1377', 'Time: 395790.0', 'Searching: 0.0', 'Contrast: 22.7', and 'Last Contrast: 0.0'.

The screenshot displays the Geo++@ GNNET - GNSS Multistation RT Network Solution NAM2 software. The interface includes a menu bar (Project, Settings, Options, Help), a station list on the left, a main grid area, and a status bar at the bottom.

**Station List (Left Panel):**

- GPS-Tracking
- GLONASS-Tre
- Rcv Ambiguity
- SV Ambiguity
- Stations
  - ters
  - wsra
  - ball
  - drac
  - 0674
  - schl
  - ame1
  - anjm
  - c028
  - c031
  - c035
  - c065
  - d050
  - d056
  - d068
  - d107
  - d110
  - pal1
  - pal2
  - pal4

**Main Grid Area:**

The grid shows data for various stations. The columns are labeled with station IDs: 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3. The rows are labeled with station IDs: ters, wsra, ball, drac, 0674, schl, ame1, anjm, c028, c031, c035, c065, d050, d056, d065, d068, d107, d110, pal1, pal2, pal4, 2686, 2689, 2691, 4025.

**Status Bar (Bottom):**

WN: 1377 Time: 383880.0 Searching: 0.0 \* Contrast: 0.6 Last Contrast: 1.3



## Further aspects of GNSMART processing

- one rigorous solution of all stations, fixed, dynamic or unknown
- all correlations known in 1 run
- uses Ultra rapid Precise orbits
- all RINEX data needs to be converted to internal Geo++ format (\*.zdb files) using the reference station module GNREF
- Very heavy computations
- Processing has to wait for end of survey campaign

## Processing steps

The following steps have been taken for the processing:

### General

- checking completeness of Ballum, Drachten and Borkum data
- repairing gaps Ballum and Drachten with locally stored data
- downloading tps-data from Schiermonnikoog, East Ameland, Anjum and Moddergat
- converting tps data to RINEX
- downloading AGRS data
- conversion AGRS data to RINEX with inverse Hatanaka compression
- conversion of tps data from Waddenzee points to RINEX format

### GNSMART

- gathering of Precise Ephemerides from internet (IGS sites)
- converting of broadcast navigation files into one overall file per day
- conversion of all RINEX file into .zdb files using the accurate position from VRS processing, antenna information and antenna heights
- running of GNNET with options of station dynamics, numbers of stations to process, etc. (see previous page for some screen dumps of GNNET)
- conversion of ETRS89 XYZ results into Latitude, Longitude and Height.
- Sorting of LLH data per station.
- Graphical analysis

Of course the GPS results give a height of each ARP (Antenna Reference Point); in our case always the bottom of the antenna. Additional measurements have taken place for the antenna heights: the vertical distance between unknown point and ARP. Every mast used has a different length and throughout the project these distances have been monitored, carefully.

Only after relating the ARP heights to the actual survey points the data can be imported in the deformation analyzing software and databases of the NAM. These offsets were measured and reported separately by Fugro Inpark.

## 4 Results

In order to obtain the best results it was first necessary to have good reference station coordinates that are not only good in absolute position, but also very homogenous: discrepancies should be as small as possible.

After having gathered a complete month (July 2006) of data all reference stations were evaluated with the GNSMART solution. Also the data of the AGRS stations Terschelling and Westerbork was entered and only these two stations and station Borkum were kept fixed. This dataset is used for all GNSMART processing. An overview of the coordinate can be found in Appendix I.

### Remarks reference stations

#### 2007

On July 12th 2007 station Borkum was moved a few meters and the equipment was modernized (station 0687 instead of 0674). A month of data was used to determine the new coordinates of Borkum using a new individual antenna calibration file and the data of all other stations to guarantee homogenous coordinates again.

#### 2008

No details.

#### 2009

In 2009, concerns about the validity of the reference coordinates resulted in a recalculation using time series from 17-05-2009 until 27-06-2009. Some discrepancies in height were found for the stations Drachten and Borkum of -6 and 3 mm respectively, see Appendix I. Drachten subsides 2 mm per year due to gas extraction, therefore it would be necessary to recalculate and report the reference coordinates each year again. All data since 03-05-2009 has been processed with new reference coordinates for Drachten and Borkum.

#### 2010

In 2010, no significant changes were found in reference station coordinates. For calculation of the Waddenzee benchmarks near Eemshaven, stations 0647 (Emden) and Veendam were added to the network. Six weeks of data were used to determine homogeneous coordinates for these stations. The coordinates of Emden and Veendam will be recalculated each year and these stations will be used only for measurements near Eemshaven. Stations Borkum and Emden got a new antenna on October 21 2010. New antenna calibration files are applied since this time.

#### 2011

In 2011, the reference station coordinates of Borkum (0687) and Terschelling (ters) got a small height correction of respectively -3.7 and 2.4 mm. These numbers are based on a recalculation using time series from 17-04-2011 until 28-05-2011. This correction affected the monitor stations with -0.5 mm.

#### 2012

OG-GPS has been asked by NAM to expand the 'refcheck' with stations Veendam (veen) and Emden (0647). These stations, as well as station Drachten (drac), are likely to be within the influence zone of gas and/or salt abstraction. These stations will also be used for comparison with InSAR data. Therefore the coordinates of these three stations are calculated again within the network for an up-to-date accurate solution. As a result of this calculation, station 'drac' got a small correction of -0.9 mm. This correction has been applied since May 6<sup>th</sup> 2012.

## 2013

In 2013, continuous monitor stations 'Ten Post' (tenp), 'De Wijk 16' (dw16) and 'De Wijk 26' (dw26) were added to the network. This means that also the reference network has been enlarged. The reference stations 'Makkum' (makk), 'Urk' (urk2), 'Beilen' (beil), 'Nieuwleusen' (nieu) and 'Meppen' (0683) are added since October 2013.

## GNSMART results Waddenzee points 2006 - 2013

In Appendix II all the Waddenzee points as well as underground benchmarks on land and the Lauwersmeer and Grijpskerk points are shown including their observation times.

The NAP Elevation of the wad points can be obtained by subtracting the leveling offsets from the NAP heights of the antenna reference points (ARP). These offsets were measured and reported separately by Fugro Inpark.

## GNSMART results Monitor Stations on land 2006 - 2013

In Appendix III, plots are shown for the GNSMART results for the 3 dynamic stations AME1, Anjum and Moddergat. From GPS day 145 2006 to day 001 2014 the elevations are shown and one can see the linear trend for the years 2007 to 2013. The position filter used is a mm/hour filter. Although the results show some noise, a subsidence is clearly visible. The trend (straight line) is determined by using a linear least squares approximation. The standard error of the noise is about 0.7 mm.

The following table contains the annual subsidence rates over the years 2007 to 2013 for the three monitor stations:

| Monitor Station  | Subsidence rates (mm/year) |      |      |      |      |      |      |
|------------------|----------------------------|------|------|------|------|------|------|
|                  | 2007                       | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| Ameland 1 (AME1) | 7.9                        | 6.9  | 7.1  | 6.2  | 7.4  | 7.4  | 6.7  |
| Anjum (ANJM)     | 4.6                        | 2.6  | 5.2  | 3.7  | 2.8  | 3.6  | 3.1  |
| Moddergat (MODD) | 1.5                        | 0.6  | 2.9  | 1.4  | 2.8  | 4.2  | 3.8  |

Since February 5<sup>th</sup> 2007, the total subsidence for the three permanent monitor stations is as follows:

| Monitor Station  | Total subsidence on 1-1-2014 (mm) |
|------------------|-----------------------------------|
| Ameland 1 (AME1) | 45.6                              |
| Anjum (ANJM)     | 25.7                              |
| Moddergat (MODD) | 17.8                              |



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## APPENDIX I: reference station parameters

Reference coordinates overview for all permanent stations together with information about the antenna type and number.  
Transformation to RD/NAP based on RDNAPTRANS2004  
Date: 1-6-2013

| Station | owner  | status | Date       | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)   | Y-RD (m)   | NAP(m) | ant.h.(m) | ARP(m) | ser.no.ant. | ant. Type   |      |
|---------|--------|--------|------------|------------------|----|----------|------------------|----|----------|------------|------------|---------|------------|------------|--------|-----------|--------|-------------|-------------|------|
| 0647    | SAPOS  | fixed  | 1-6-2013   | 53               | 20 | 14.76812 | 7                | 1  | 38.98408 | 56.9572    | 0.0550     | 57.0122 | 264259.041 | 595802.044 | 16.461 | 0.055     | 16.516 | 10211016    | LEIAR25.R4  | LEIT |
| 0683    | SAPOS  | fixed  | 26-10-2013 | 52               | 42 | 57.21129 | 7                | 18 | 55.66306 | 89.2454    | 0.0520     | 89.2974 | 285286.473 | 527127.601 | 47.091 | 0.052     | 47.143 | 10231023    | LEIAR25.R4  | LEIT |
| 0687    | SAPOS  | fixed  | 28-5-2011  | 53               | 33 | 49.15576 | 6                | 44 | 50.78843 | 54.4054    | 0.0550     | 54.4604 | 245130.122 | 620588.003 | 14.221 | 0.055     | 14.276 | 10211024    | LEIAR25.R4  | LEIT |
| ball    | 06-GPS | fixed  | 2006       | 53               | 26 | 29.58829 | 5                | 41 | 15.67011 | 54.5499    | 0.1010     | 54.6509 | 174967.385 | 606186.357 | 13.721 | 0.101     | 13.822 | 2170556     | TPSCR3_GGD  | CONE |
| beil    | 06-GPS | fixed  | 26-10-2013 | 52               | 51 | 37.49852 | 6                | 30 | 54.37391 | 71.3793    | 0.0990     | 71.4783 | 230961.813 | 542064.730 | 29.649 | 0.099     | 29.748 | 2170563     | TPSCR3_GGD  | CONE |
| drac    | 06-GPS | fixed  | 1-6-2013   | 53               | 6  | 31.75472 | 6                | 4  | 58.04659 | 56.3471    | 0.1470     | 56.4941 | 201580.587 | 569339.066 | 15.033 | 0.147     | 15.180 | 2170593     | TPSCR3_GGD  | CONE |
| makk    | 06-GPS | fixed  | 26-10-2013 | 53               | 3  | 36.43453 | 5                | 23 | 50.91281 | 59.4181    | 0.1470     | 59.5651 | 155688.445 | 563694.695 | 17.679 | 0.147     | 17.826 | 3830141     | TPSCR.G3    | TPSH |
| nieu    | 06-GPS | fixed  | 26-10-2013 | 52               | 35 | 14.08076 | 6                | 16 | 57.49715 | 61.3727    | 0.1480     | 61.5207 | 215682.954 | 511450.194 | 18.841 | 0.148     | 18.989 | 3830174     | TPSCR.G3    | TPSH |
| schi    | NAM    | fixed  | 2006       | 53               | 28 | 38.43917 | 6                | 9  | 44.16452 | 50.8109    | 0.1480     | 50.9589 | 206461.096 | 610405.714 | 10.355 | 0.148     | 10.503 | 2170643     | TPSCR3_GGD  | CONE |
| ters    | AGRS   | fixed  | 28-5-2011  | 53               | 21 | 45.84880 | 5                | 13 | 9.78844  | 56.1032    | 0.0000     | 56.1032 | 143827.239 | 597385.490 | 14.692 | 0.000     | 14.692 | 220193243   | trm29659.00 |      |
| urk2    | 06-GPS | fixed  | 26-10-2013 | 52               | 39 | 49.41043 | 5                | 36 | 8.55297  | 54.4002    | 0.1480     | 54.5482 | 169556.792 | 519606.277 | 11.971 | 0.148     | 12.119 | 3830190     | TPSCR.G3    | TPSH |
| wsra    | AGRS   | fixed  | 2006       | 52               | 54 | 52.58952 | 6                | 36 | 16.20634 | 82.2751    | 0.3890     | 82.6641 | 236880.505 | 548192.313 | 40.725 | 0.389     | 41.114 | 273         | AOAD/M_T    |      |

| Station | owner | status | Date       | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)   | Y-RD (m)   | NAP(m) | ant.h.(m) | ARP(m) | ser.no.ant. | ant. Type  |      |
|---------|-------|--------|------------|------------------|----|----------|------------------|----|----------|------------|------------|---------|------------|------------|--------|-----------|--------|-------------|------------|------|
| ame1    | NAM   | mobile | 1-6-2013   | 53               | 27 | 51.94297 | 5                | 55 | 16.80627 | 47.9691    | 0.1480     | 48.1171 | 190474.975 | 608822.483 | 7.375  | 0.148     | 7.523  | 2170510     | TPSCR3_GGD | CONE |
| anjm    | NAM   | mobile | 1-6-2013   | 53               | 22 | 15.04189 | 6                | 9  | 8.59121  | 45.2577    | 0.0000     | 45.2577 | 205931.137 | 598546.044 | 4.631  | 0.000     | 4.631  | 2170642     | TPSCR3_GGD | CONE |
| dw16    | NAM   | mobile | 26-10-2013 | 52               | 41 | 46.55932 | 6                | 23 | 45.68714 | 52.5833    | 0.1470     | 52.7303 | 223197.475 | 523681.516 | 10.378 | 0.147     | 10.525 | 762-10982   | TPSCR.G5   | TPSH |
| dw26    | NAM   | mobile | 26-10-2013 | 52               | 41 | 33.84566 | 6                | 19 | 4.90103  | 49.1305    | 0.1470     | 49.2775 | 217930.096 | 523217.805 | 6.879  | 0.147     | 7.026  | 762-11009   | TPSCR.G5   | TPSH |
| modd    | NAM   | mobile | 1-6-2013   | 53               | 24 | 19.27163 | 6                | 4  | 2.98533  | 47.4022    | 0.1470     | 47.5492 | 200244.557 | 602329.795 | 6.790  | 0.147     | 6.937  | 2170639     | TPSCR3_GGD | CONE |
| tenp    | NAM   | mobile | 1-6-2013   | 53               | 17 | 57.24969 | 6                | 44 | 40.74112 | 47.6573    | 0.1480     | 47.8053 | 245500.603 | 591158.827 | 7.107  | 0.148     | 7.255  | 762-10980   | TPSCR.G5   | TPSH |
| veen    | NAM   | mobile | 1-6-2013   | 53               | 6  | 15.38219 | 6                | 51 | 54.03528 | 65.9142    | 0.1470     | 66.0612 | 253969.381 | 569622.684 | 24.938 | 0.147     | 25.085 | 3830189     | TPSCR.G3   | TPSH |



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## APPENDIX II: GNSMART results Waddenzee points 2006 - 2013 plus overview maps

### GNSMART processing Waddenzee, NES, Lauwersmeer and Grijpskerk 2006

Operator: 06-GPS

Date: 10-8-2007

| Station | owner  | GPS day | hr    | Date | N [ø,']" | ETRS89 (m) | E [ø,']" | ETRS89 (m) | ell. h [m] | ant. h. (m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant. h. (m) | ARP (m) | ser. no.  | ant.        | ant. Type |
|---------|--------|---------|-------|------|----------|------------|----------|------------|------------|-------------|---------|------------|------------|-----------|-------------|---------|-----------|-------------|-----------|
| 0674    | SAPOS  |         | fixed |      | 53 33    | 49.10129   | 6 44     | 50.79499   | 54.2100    | 0.053       | 54.2630 | 245130.275 | 620586.321 | 14.026    | 0.053       | 14.079  | 220180416 | TRM29659.00 | SNOW      |
| ball    | 06-GPS |         | fixed |      | 53 26    | 29.58829   | 5 41     | 15.67011   | 54.5499    | 0.101       | 54.6509 | 174967.385 | 606186.357 | 13.721    | 0.101       | 13.822  | 2170556   | TPSCR3_GGD  | CONE      |
| drac    | 06-GPS |         | fixed |      | 53 6     | 31.75441   | 6 4      | 58.04678   | 56.3542    | 0.147       | 56.5012 | 201580.590 | 569339.057 | 15.040    | 0.147       | 15.187  | 2170593   | TPSCR3_GGD  | CONE      |
| schi    | NAM    |         | fixed |      | 53 28    | 38.43917   | 6 9      | 44.16452   | 50.8109    | 0.148       | 50.9589 | 206461.096 | 610405.714 | 10.355    | 0.148       | 10.503  | 2170643   | TPSCR3_GGD  | CONE      |

| Station | owner | GPS day | hr    | Date | N [ø,']" | ETRS89 (m) | E [ø,']" | ETRS89 (m) | ell. h [m] | ant. h. (m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant. h. (m) | ARP (m) | ser. no.  | ant.        | ant. Type |
|---------|-------|---------|-------|------|----------|------------|----------|------------|------------|-------------|---------|------------|------------|-----------|-------------|---------|-----------|-------------|-----------|
| ters    | AGRS  |         | fixed |      | 53 21    | 45.84903   | 5 13     | 9.78826    | 56.1008    | 0.000       | 56.1008 | 143827.236 | 597385.497 | 14.689    | 0.000       | 14.689  | 220193243 | TRM29659.00 |           |
| wsra    | AGRS  |         | fixed |      | 52 54    | 52.58929   | 6 36     | 16.20650   | 82.2751    | 0.389       | 82.6641 | 236880.508 | 548192.306 | 40.725    | 0.389       | 41.114  | 273       | AOAD/M_T    |           |

| Station | owner | GPS day | hr | Date      | N [ø,']" | ETRS89 (m) | E [ø,']" | ETRS89 (m) | ell. h [m] | ant. h. (m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant. h. (m) | ARP (m) | ser. no. | ant.       | ant. Type |
|---------|-------|---------|----|-----------|----------|------------|----------|------------|------------|-------------|---------|------------|------------|-----------|-------------|---------|----------|------------|-----------|
| ame1    | NAM   | 231     | j  | 19-8-2006 | 53 27    | 51.94252   | 5 55     | 16.80639   | 48.0131    | 0.148       | 48.1611 | 190474.978 | 608822.469 | 7.419     | 0.148       | 7.567   | 2170510  | TPSCR3_GGD | CONE      |
| anjm    | NAM   | 231     | j  | 19-8-2006 | 53 22    | 15.04173   | 6 9      | 8.59165    | 45.2831    | 0.000       | 45.2831 | 205931.145 | 598546.039 | 4.657     | 0.000       | 4.657   | 2170642  | TPSCR3_GGD | CONE      |

| Station | Waddenzee | GPS day | hr | Date      | N [ø,']" |    | ETRS89 (m) |  | E [ø,']" |    | ETRS89 (m) |  | ell. h [m] | ant. h. (m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant. h. (m) | ARP (m) | ser. no. | ant.       | ant. Type |
|---------|-----------|---------|----|-----------|----------|----|------------|--|----------|----|------------|--|------------|-------------|---------|------------|------------|-----------|-------------|---------|----------|------------|-----------|
| 2686    | OA2686    | 205     | h  | 24-7-2006 | 53       | 23 | 55.03241   |  | 6        | 5  | 11.58759   |  | 45.8130    | 0.000       | 45.8130 | 201519.194 | 601592.605 | 5.198     | 0.000       | 5.198   | 2170628  | TPSCR3_GGD | CONE      |
| 2689    | OA2689    | 186     | k  | 5-7-2006  | 53       | 23 | 6.63993    |  | 6        | 14 | 11.21185   |  | 43.9562    | 0.000       | 43.9562 | 211507.364 | 600203.909 | 3.396     | 0.000       | 3.396   | 2170639  | TPSCR3_GGD | CONE      |
| 2691    | OA2691    | 198     | k  | 17-7-2006 | 53       | 24 | 11.28179   |  | 6        | 8  | 24.27264   |  | 46.2653    | 0.000       | 46.2653 | 205074.132 | 602130.891 | 5.684     | 0.000       | 5.684   | 2170628  | TPSCR3_GGD | CONE      |



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|      |        |     |   |           |    |    |          |   |    |          |         |       |         |            |            |       |       |       |         |            |      |
|------|--------|-----|---|-----------|----|----|----------|---|----|----------|---------|-------|---------|------------|------------|-------|-------|-------|---------|------------|------|
| 4025 | OA4025 | 210 | r | 29-7-2006 | 53 | 24 | 30.91220 | 6 | 11 | 52.49942 | 48.7620 | 0.000 | 48.7620 | 208914.240 | 602779.561 | 8.218 | 0.000 | 8.218 | 2170628 | TPSCR3_GGD | CONE |
| c028 | 2C0028 | 162 | n | 11-6-2006 | 53 | 24 | 38.02227 | 5 | 53 | 34.26421 | 43.6227 | 0.000 | 43.6227 | 188625.315 | 602813.658 | 2.904 | 0.000 | 2.904 | 2170639 | TPSCR3_GGD | CONE |
| c031 | 2C0031 | 155 | g | 4-6-2006  | 53 | 25 | 35.75089 | 5 | 53 | 25.67546 | 43.6470 | 0.000 | 43.6470 | 188454.180 | 604597.236 | 2.958 | 0.000 | 2.958 | 2170639 | TPSCR3_GGD | CONE |
| c035 | 2C0035 | 157 | i | 6-6-2006  | 53 | 26 | 35.98683 | 5 | 53 | 21.05011 | 43.7617 | 0.000 | 43.7617 | 188355.777 | 606458.856 | 3.103 | 0.000 | 3.103 | 2170628 | TPSCR3_GGD | CONE |
| c065 | 2C0065 | 153 | d | 2-6-2006  | 53 | 24 | 47.22433 | 5 | 50 | 10.25247 | 44.2272 | 0.000 | 44.2272 | 184854.984 | 603073.135 | 3.469 | 0.000 | 3.469 | 2170626 | TPSCR3_GGD | CONE |
| d050 | 2D0050 | 164 | n | 13-6-2006 | 53 | 27 | 10.40297 | 5 | 55 | 14.01566 | 44.1785 | 0.000 | 44.1785 | 190433.019 | 607537.862 | 3.563 | 0.000 | 3.563 | 2170628 | TPSCR3_GGD | CONE |
| d056 | 2D0056 | 174 | l | 23-6-2006 | 53 | 24 | 15.08393 | 5 | 55 | 14.02781 | 43.6905 | 0.000 | 43.6905 | 190473.428 | 602117.836 | 2.984 | 0.000 | 2.984 | 2170626 | TPSCR3_GGD | CONE |
| d061 | 2D0061 | 178 | n | 27-6-2006 | 53 | 27 | 22.96277 | 6 | 3  | 42.72470 | 45.4528 | 0.000 | 45.4528 | 199816.981 | 608005.084 | 4.921 | 0.000 | 4.921 | 2170640 | TPSCR3_GGD | CONE |
| d065 | 2D0065 | 168 | f | 17-6-2006 | 53 | 25 | 7.17590  | 5 | 59 | 1.71138  | 43.5803 | 0.000 | 43.5803 | 194666.505 | 603761.321 | 2.948 | 0.000 | 2.948 | 2170626 | TPSCR3_GGD | CONE |
| d068 | 2D0068 | 166 | p | 15-6-2006 | 53 | 24 | 56.05825 | 5 | 57 | 6.60893  | 43.8702 | 0.000 | 43.8702 | 192543.417 | 603400.441 | 3.211 | 0.000 | 3.211 | 2170640 | TPSCR3_GGD | CONE |
| d107 | 2D0107 | 160 | k | 9-6-2006  | 53 | 25 | 59.63059 | 5 | 56 | 12.74178 | 43.4600 | 0.000 | 43.4600 | 191533.473 | 605358.074 | 2.822 | 0.000 | 2.822 | 2170640 | TPSCR3_GGD | CONE |
| d110 | 2D0110 | 170 | f | 19-6-2006 | 53 | 25 | 49.83129 | 6 | 0  | 3.69777  | 44.1699 | 0.000 | 44.1699 | 195800.046 | 605089.656 | 3.568 | 0.000 | 3.568 | 2170628 | TPSCR3_GGD | CONE |
| g043 | 2G0043 | 181 | f | 30-6-2006 | 53 | 25 | 15.80987 | 6 | 6  | 8.04372  | 44.1013 | 0.000 | 44.1013 | 202537.498 | 604100.077 | 3.531 | 0.000 | 3.531 | 2170626 | TPSCR3_GGD | CONE |
| g049 | 2G0049 | 186 | g | 5-7-2006  | 53 | 26 | 6.37338  | 6 | 3  | 58.89715 | 43.6931 | 0.000 | 43.6931 | 200137.765 | 605640.121 | 3.130 | 0.000 | 3.13  | 2170639 | TPSCR3_GGD | CONE |
| h033 | 2H0033 | 219 | k | 7-8-2006  | 53 | 24 | 26.73922 | 6 | 17 | 11.87499 | 43.6014 | 0.000 | 43.6014 | 214815.481 | 602720.678 | 3.101 | 0.000 | 3.101 | 2170639 | TPSCR3_GGD | CONE |
| h036 | 2H0036 | 228 | s | 16-8-2006 | 53 | 25 | 3.80587  | 6 | 19 | 15.26486 | 43.8694 | 0.000 | 43.8694 | 217079.936 | 603895.609 | 3.402 | 0.000 | 3.402 | 2170639 | TPSCR3_GGD | CONE |
| h039 | 2H0039 | 190 | j | 9-7-2006  | 53 | 26 | 19.44854 | 6 | 14 | 18.02732 | 44.5079 | 0.000 | 44.5079 | 211562.765 | 606165.962 | 4.030 | 0.000 | 4.03  | 2170640 | TPSCR3_GGD | CONE |
| h043 | 2H0043 | 184 | f | 3-7-2006  | 53 | 27 | 27.04844 | 6 | 15 | 1.99925  | 43.7375 | 0.000 | 43.7375 | 212349.349 | 608265.475 | 3.295 | 0.000 | 3.295 | 2170640 | TPSCR3_GGD | CONE |
| h048 | 2H0048 | 231 | j | 19-8-2006 | 53 | 27 | 56.62090 | 6 | 16 | 42.47593 | 43.7053 | 0.000 | 43.7053 | 214191.923 | 609202.327 | 3.290 | 0.000 | 3.29  | 2170626 | TPSCR3_GGD | CONE |
| h058 | 2H0058 | 188 | i | 7-7-2006  | 53 | 26 | 22.75407 | 6 | 18 | 27.49826 | 44.0874 | 0.000 | 44.0874 | 216166.511 | 606324.875 | 3.647 | 0.000 | 3.647 | 2170626 | TPSCR3_GGD | CONE |
| m001 |        | 222 | n | 10-8-2006 | 53 | 26 | 7.99561  | 5 | 54 | 39.83071 | 43.5908 | 0.000 | 43.5908 | 189816.224 | 605603.869 | 2.936 | 0.000 | 2.936 | 2170640 | TPSCR3_GGD | CONE |
| m002 |        | 221 | n | 9-8-2006  | 53 | 26 | 35.83770 | 5 | 55 | 45.69337 | 43.5927 | 0.000 | 43.5927 | 191025.656 | 606473.635 | 2.967 | 0.000 | 2.967 | 2170626 | TPSCR3_GGD | CONE |
| m003 |        | 215 | e | 3-8-2006  | 53 | 25 | 19.63159 | 6 | 1  | 9.33138  | 44.3200 | 0.000 | 44.3200 | 197020.070 | 604166.538 | 3.713 | 0.000 | 3.713 | 2170626 | TPSCR3_GGD | CONE |
| m004 |        | 178 | l | 27-6-2006 | 53 | 28 | 1.57049  | 6 | 2  | 55.13899 | 44.8069 | 0.000 | 44.8069 | 198927.941 | 609190.495 | 4.287 | 0.000 | 4.287 | 2170628 | TPSCR3_GGD | CONE |
| m005 |        | 208 | l | 27-7-2006 | 53 | 26 | 32.01564 | 6 | 0  | 41.41410 | 44.5727 | 0.000 | 44.5727 | 196485.092 | 606399.792 | 3.996 | 0.000 | 3.996 | 2170640 | TPSCR3_GGD | CONE |
| m006 |        | 214 | g | 2-8-2006  | 53 | 25 | 41.05154 | 6 | 2  | 20.20155 | 43.8185 | 0.000 | 43.8185 | 198322.819 | 604840.424 | 3.231 | 0.000 | 3.231 | 2170640 | TPSCR3_GGD | CONE |
| m007 |        | 206 | m | 25-7-2006 | 53 | 24 | 41.68937 | 6 | 2  | 26.58380 | 44.0207 | 0.000 | 44.0207 | 198457.340 | 603006.317 | 3.406 | 0.000 | 3.406 | 2170626 | TPSCR3_GGD | CONE |





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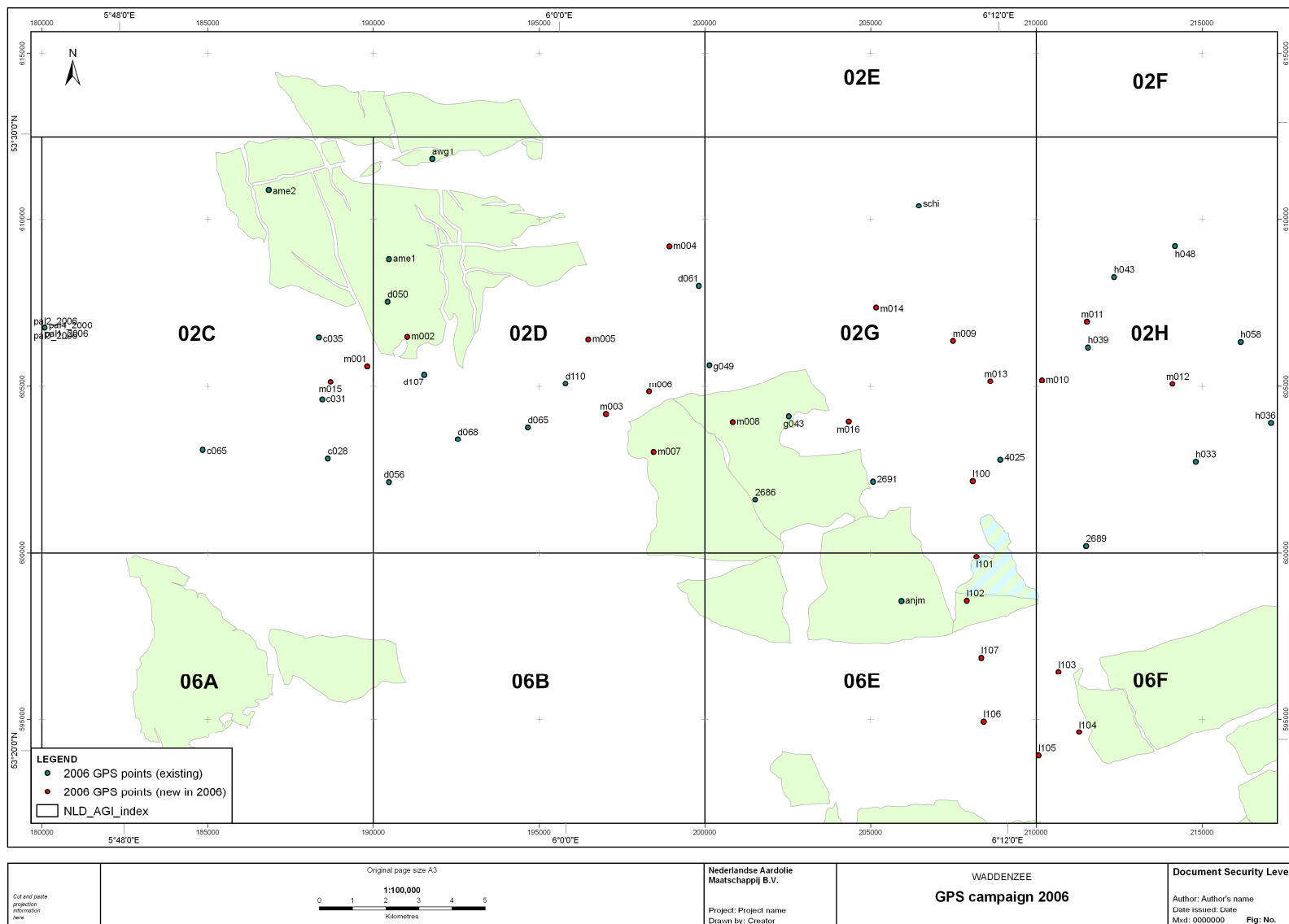
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|-----------|---------|-----|---|------------|----|----|----------|---|----|----------|---------|-------|---------|------------|------------|--------|-------|--------|---------|------------|------|
| m008      |         | 202 | i | 21-7-2006  | 53 | 25 | 10.47012 | 6 | 4  | 36.11249 | 44.0807 | 0.000 | 44.0807 | 200841.374 | 603918.416 | 3.497  | 0.000 | 3.497  | 2170640 | TPSCR3_GGD | CONE |
| m009      |         | 198 | e | 17-7-2006  | 53 | 26 | 27.04000 | 6 | 10 | 37.80202 | 44.2611 | 0.000 | 44.2611 | 207494.959 | 606354.267 | 3.756  | 0.000 | 3.756  | 2170639 | TPSCR3_GGD | CONE |
| m010      |         | 192 | m | 11-7-2006  | 53 | 25 | 48.45509 | 6 | 13 | 2.08206  | 43.9265 | 0.000 | 43.9265 | 210171.926 | 605191.422 | 3.425  | 0.000 | 3.425  | 2170639 | TPSCR3_GGD | CONE |
| m011      |         | 210 | e | 29-7-2006  | 53 | 26 | 44.81334 | 6 | 14 | 16.74814 | 44.5394 | 0.000 | 44.5394 | 211529.869 | 606949.829 | 4.072  | 0.000 | 4.072  | 2170639 | TPSCR3_GGD | CONE |
| m012      |         | 200 | g | 19-7-2006  | 53 | 25 | 43.37993 | 6 | 16 | 35.19250 | 44.1981 | 0.000 | 44.1981 | 214108.539 | 605081.553 | 3.725  | 0.000 | 3.725  | 2170626 | TPSCR3_GGD | CONE |
| m013      |         | 194 | o | 13-7-2006  | 53 | 25 | 47.87474 | 6 | 11 | 37.70086 | 43.3221 | 0.000 | 43.3221 | 208614.186 | 605155.755 | 2.809  | 0.000 | 2.809  | 2170626 | TPSCR3_GGD | CONE |
| m014      |         | 196 | d | 15-7-2006  | 53 | 27 | 0.56298  | 6 | 8  | 32.72209 | 44.6332 | 0.000 | 44.6332 | 205175.280 | 607365.822 | 4.125  | 0.000 | 4.125  | 2170640 | TPSCR3_GGD | CONE |
| m015      |         | 204 | l | 23-7-2006  | 53 | 25 | 53.26568 | 5 | 53 | 40.02823 | 43.6752 | 0.000 | 43.6752 | 188715.391 | 605140.572 | 2.999  | 0.000 | 2.999  | 2170639 | TPSCR3_GGD | CONE |
| m016      |         | 229 | f | 17-8-2006  | 53 | 25 | 9.86559  | 6 | 7  | 45.54013 | 44.2172 | 0.000 | 44.2172 | 204339.870 | 603934.554 | 3.656  | 0.000 | 3.656  | 2170640 | TPSCR3_GGD | CONE |
| pal1_2006 | Nes     | 159 | l | 8-6-2006   | 53 | 26 | 46.90931 | 5 | 45 | 53.11527 | 49.6692 | 0.000 | 49.6692 | 180085.922 | 606746.014 | 8.917  | 0.000 | 8.917  | 2170626 | TPSCR3_GGD | CONE |
| pal2_2006 | Nes     | 173 | h | 22-6-2006  | 53 | 26 | 46.91124 | 5 | 45 | 53.11421 | 49.6660 | 0.000 | 49.6660 | 180085.902 | 606746.074 | 8.914  | 0.000 | 8.914  | 2170639 | TPSCR3_GGD | CONE |
| pal3_2006 | Nes     | 192 | g | 11-7-2006  | 53 | 26 | 46.90882 | 5 | 45 | 53.11531 | 49.6661 | 0.000 | 49.6661 | 180085.923 | 606745.999 | 8.914  | 0.000 | 8.914  | 2170628 | TPSCR3_GGD | CONE |
| pal4_2006 | Nes     | 152 | l | 1-6-2006   | 53 | 26 | 46.91007 | 5 | 45 | 53.11576 | 49.6648 | 0.000 | 49.6648 | 180085.931 | 606746.038 | 8.913  | 0.000 | 8.913  | 2170640 | TPSCR3_GGD | CONE |
| l100      |         | 254 | f | 11-9-2006  | 53 | 24 | 10.77766 | 6 | 11 | 6.95316  | 44.4329 | 0.000 | 44.4329 | 208079.796 | 602147.705 | 3.874  | 0.000 | 3.874  | 2170640 | TPSCR3_GGD | CONE |
| l101      |         | 254 | i | 11-9-2006  | 53 | 22 | 57.32078 | 6 | 11 | 11.96404 | 44.4919 | 0.000 | 44.4919 | 208197.615 | 599877.861 | 3.902  | 0.000 | 3.902  | 2170626 | TPSCR3_GGD | CONE |
| l102      |         | 263 | f | 20-9-2006  | 53 | 22 | 14.52646 | 6 | 10 | 55.55928 | 44.4746 | 0.000 | 44.4746 | 207909.015 | 598551.549 | 3.863  | 0.000 | 3.863  | 2170626 | TPSCR3_GGD | CONE |
| l103      |         | 247 | l | 4-9-2006   | 53 | 21 | 4.17227  | 6 | 13 | 23.97293 | 44.4293 | 0.000 | 44.4293 | 210678.272 | 596407.728 | 3.808  | 0.000 | 3.808  | 2170626 | TPSCR3_GGD | CONE |
| l104      |         | 263 | i | 20-9-2006  | 53 | 20 | 5.63512  | 6 | 13 | 56.17303 | 45.4458 | 0.000 | 45.4458 | 211295.131 | 594605.091 | 4.802  | 0.000 | 4.802  | 2170628 | TPSCR3_GGD | CONE |
| l105      |         | 257 | g | 14-9-2006  | 53 | 19 | 43.31404 | 6 | 12 | 49.85257 | 45.5905 | 0.000 | 45.5905 | 210075.858 | 593900.812 | 4.925  | 0.000 | 4.925  | 2170628 | TPSCR3_GGD | CONE |
| l106      |         | 254 | g | 11-9-2006  | 53 | 20 | 17.27984 | 6 | 11 | 20.66661 | 44.2632 | 0.000 | 44.2632 | 208413.614 | 594932.146 | 3.601  | 0.000 | 3.601  | 2170639 | TPSCR3_GGD | CONE |
| l107      |         | 247 | g | 4-9-2006   | 53 | 21 | 18.8153  | 6 | 11 | 18.12325 | 44.3863 | 0.000 | 44.3863 | 208345.374 | 596833.920 | 3.753  | 0.000 | 3.753  | 2170639 | TPSCR3_GGD | CONE |
| gr01      | Gr'kerk | 271 | x | 28-9-2006  | 53 | 16 | 51.15124 | 6 | 18 | 25.53842 | 46.2214 | 0.000 | 46.2214 | 216356.274 | 588654.144 | 5.511  | 0.000 | 5.511  | 2170626 | TPSCR3_GGD | CONE |
| gr02      | Gr'kerk | 271 | x | 28-9-2006  | 53 | 16 | 51.41382 | 6 | 18 | 25.53854 | 46.0138 | 0.000 | 46.0138 | 216356.173 | 588662.261 | 5.303  | 0.000 | 5.303  | 2170639 | TPSCR3_GGD | CONE |
| gr03      | Gr'kerk | 270 | q | 27-9-2006  | 53 | 16 | 51.67243 | 6 | 18 | 25.53688 | 46.2093 | 0.000 | 46.2093 | 216356.040 | 588670.255 | 5.499  | 0.000 | 5.499  | 2170628 | TPSCR3_GGD | CONE |
| gr04      | Gr'kerk | 271 | x | 28-9-2006  | 53 | 16 | 51.92875 | 6 | 18 | 25.54089 | 45.9871 | 0.000 | 45.9871 | 216356.013 | 588678.180 | 5.277  | 0.000 | 5.277  | 2170640 | TPSCR3_GGD | CONE |
| ame2      | NAM     | 319 | x | 15-11-2006 | 53 | 28 | 59.89339 | 5 | 52 | 0.69925  | 69.7759 | 0.000 | 69.7759 | 186842.964 | 610897.745 | 29.176 | 0.000 | 29.176 | 2170639 | TPSCR3_GGD | CONE |
| awg1      | NAM     | 320 | x | 16-11-2006 | 53 | 29 | 28.82919 | 5 | 56 | 28.72303 | 79.3532 | 0.000 | 79.3532 | 191778.669 | 611827.868 | 38.820 | 0.000 | 38.820 | 2170626 | TPSCR3_GGD | CONE |

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#### GNSMART processing Waddenzee, NES 2007

Operator: 06-GPS

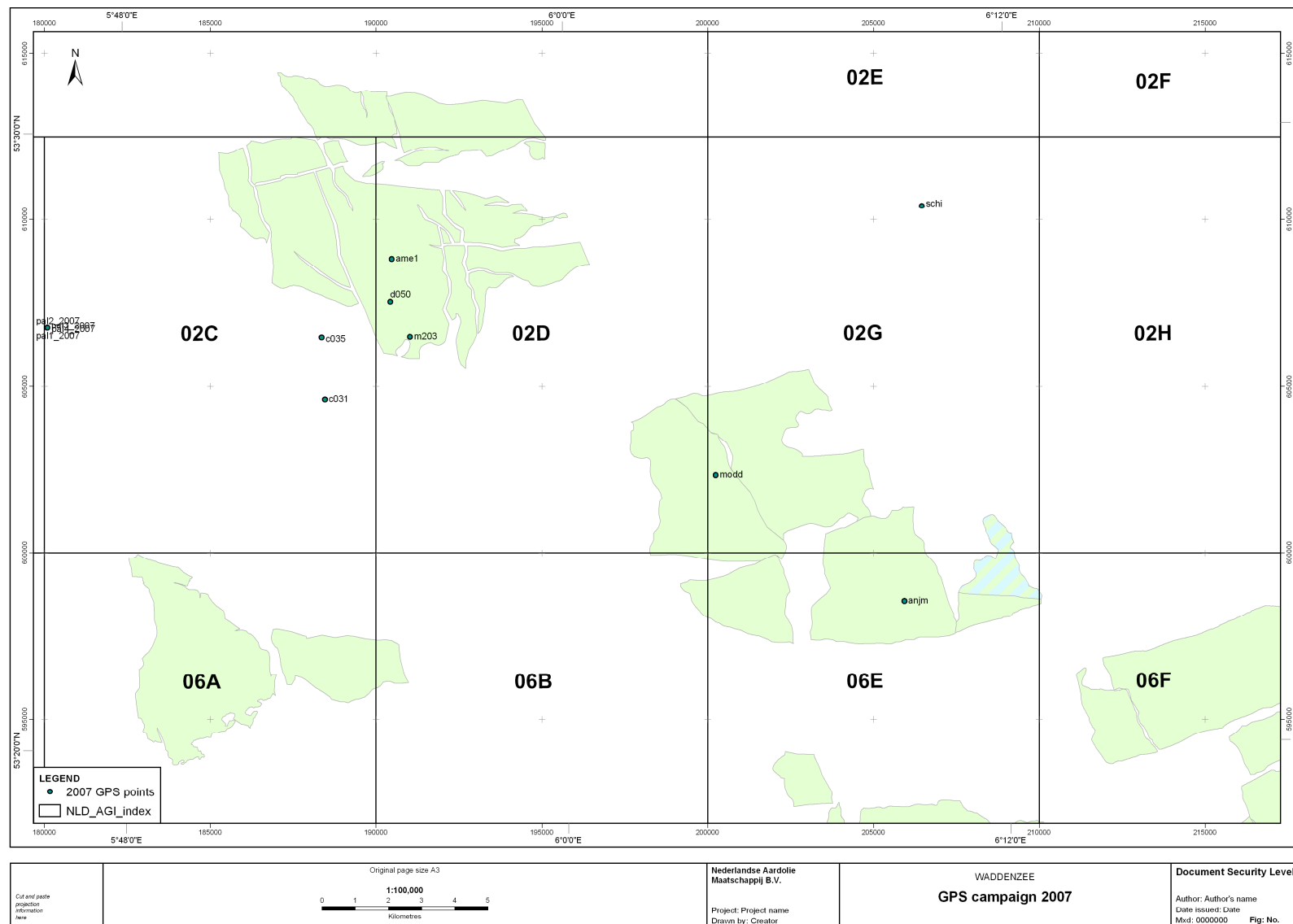
Date: 10-8-2007

| Station | owner  | GPS day      | h        | Date | N [ø,']" | ETRS89   | E [ø,']" | ETRS89   | ell. h [m] | ant. h. | ARP     | X-RD       | Y-RD       | Z-NAP  | ant. h. | ARP    | ser. no. ant. | ant. Type        |
|---------|--------|--------------|----------|------|----------|----------|----------|----------|------------|---------|---------|------------|------------|--------|---------|--------|---------------|------------------|
| 0674    | SAPOS  | fixed before | 3-6-2007 |      | 53 33    | 49.10129 | 6 44     | 50.79499 | 54.2100    | 0.053   | 54.2630 | 245130.275 | 620586.321 | 14.026 | 0.053   | 14.079 | 220180416     | TRM29659.00 SNOW |
| 0687    | SAPOS  | fixed after  | 5-6-2007 |      | 53 33    | 49.15550 | 6 44     | 50.78800 | 54.4070    | 0.054   | 54.4610 | 245130.114 | 620587.995 | 14.223 | 0.054   | 14.277 | 200110        | LEIAT504GG       |
| ball    | 06-GPS | fixed        |          |      | 53 26    | 29.58829 | 5 41     | 15.67011 | 54.5499    | 0.101   | 54.6509 | 174967.385 | 606186.357 | 13.721 | 0.101   | 13.822 | 2170556       | TPSCR3_GGD CONE  |
| drac    | 06-GPS | fixed        |          |      | 53 6     | 31.75441 | 6 4      | 58.04678 | 56.3542    | 0.147   | 56.5012 | 201580.590 | 569339.057 | 15.040 | 0.147   | 15.187 | 2170593       | TPSCR3_GGD CONE  |
| schi    | NAM    | fixed        |          |      | 53 28    | 38.43917 | 6 9      | 44.16452 | 50.8109    | 0.148   | 50.9589 | 206461.096 | 610405.714 | 10.355 | 0.148   | 10.503 | 2170643       | TPSCR3_GGD CONE  |
| ters    | AGRS   | fixed        |          |      | 53 21    | 45.84903 | 5 13     | 9.78826  | 56.1008    | 0.000   | 56.1008 | 143827.236 | 597385.497 | 14.689 | 0.000   | 14.689 | 220193243     | TRM29659.00      |
| wsra    | AGRS   | fixed        |          |      | 52 54    | 52.58929 | 6 36     | 16.20650 | 82.2751    | 0.389   | 82.6641 | 236880.508 | 548192.306 | 40.725 | 0.389   | 41.114 | 273           | AOAD/M T         |

| Station | owner | GPS day | h | Date     | N [ø,']" | ETRS89   | E [ø,']" | ETRS89   | ell. h [m] | ant. h. | ARP     | X-RD       | Y-RD       | Z-NAP | ant. h. | ARP   | ser. no. ant. | ant. Type       |
|---------|-------|---------|---|----------|----------|----------|----------|----------|------------|---------|---------|------------|------------|-------|---------|-------|---------------|-----------------|
| ame1    | NAM   | 188     | x | 7-7-2007 | 53 27    | 51.94252 | 5 55     | 16.80639 | 48.0064    | 0.148   | 48.1544 | 190474.978 | 608822.469 | 7.412 | 0.148   | 7.560 | 2170510       | TPSCR3_GGD CONE |
| anjm    | NAM   | 188     | x | 7-7-2007 | 53 22    | 15.04173 | 6 9      | 8.59165  | 45.2793    | 0.000   | 45.2793 | 205931.145 | 598546.039 | 4.653 | 0.000   | 4.653 | 2170642       | TPSCR3_GGD CONE |
| modd    | NAM   | 188     | x | 7-7-2007 | 53 24    | 19.27159 | 6 4      | 2.98541  | 47.4195    | 0.147   | 47.5665 | 200244.559 | 602329.794 | 6.807 | 0.147   | 6.954 | 2170639       | TPSCR3_GGD CONE |

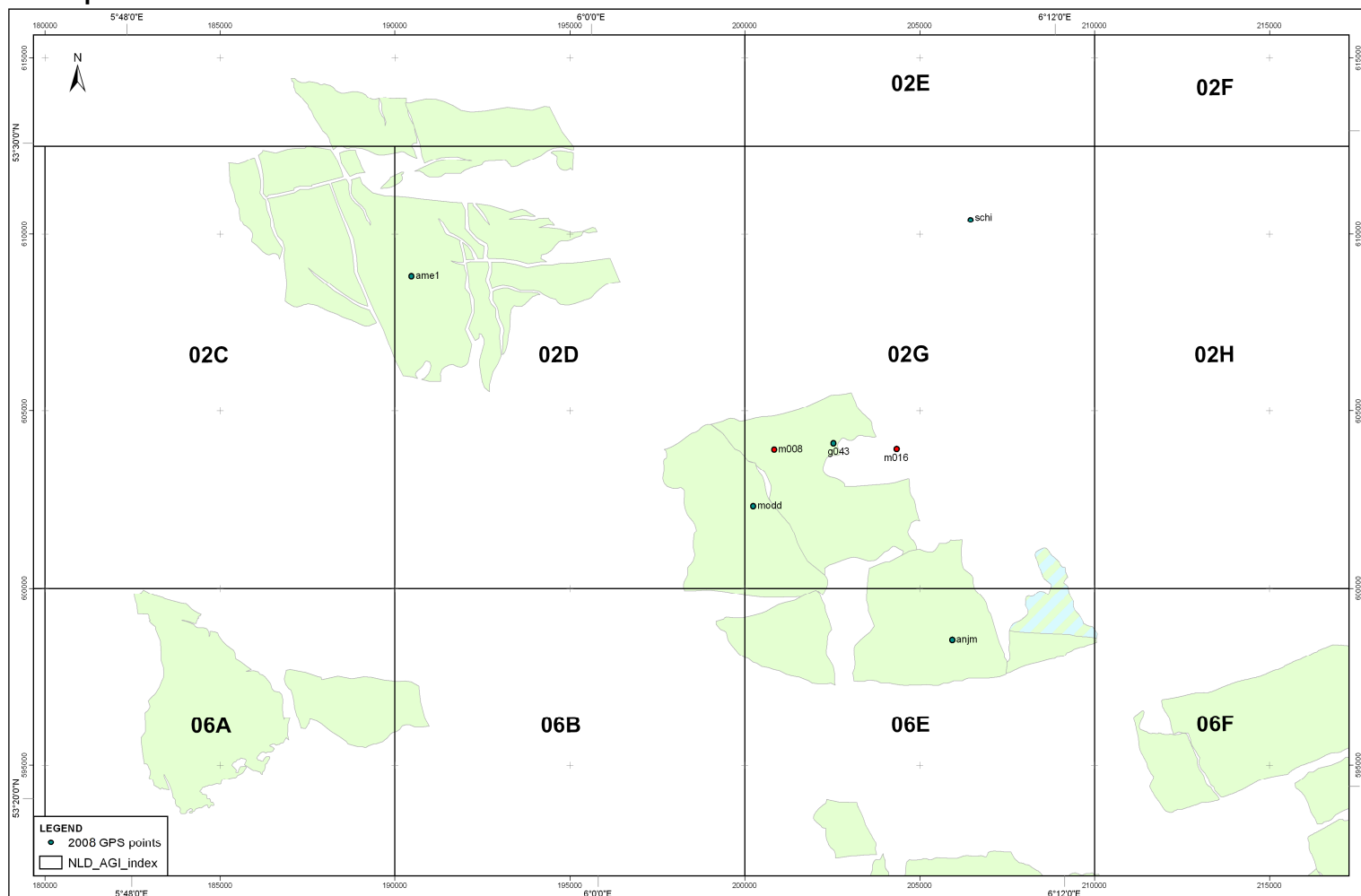
| Station Waddenzee |        | GPS day | r | Date      | N [ø,']" |    | ETRS89   | E [ø,']" |    | ETRS89   | ell. h [m] | ant. h. | ARP     | X-RD       | Y-RD       | Z-NAP | ant. h. | ARP   | ser. no. | ant.       | ant. Type |
|-------------------|--------|---------|---|-----------|----------|----|----------|----------|----|----------|------------|---------|---------|------------|------------|-------|---------|-------|----------|------------|-----------|
| c031              | 2C0031 | 183     | o | 2-7-2007  | 53       | 25 | 35.74948 | 5        | 53 | 25.67714 | 43.6628    | 0.000   | 43.6628 | 188454.211 | 604597.192 | 2.974 | 0.000   | 2.974 | 2170640  | TPSCR3_GGD | CONE      |
| c035              | 2C0035 | 170     | n | 19-6-2007 | 53       | 26 | 35.98647 | 5        | 53 | 21.05131 | 43.7109    | 0.000   | 43.7109 | 188355.799 | 606458.845 | 3.053 | 0.000   | 3.053 | 2170626  | TPSCR3_GGD | CONE      |
| d050              | 2D0050 | 170     | h | 19-6-2007 | 53       | 27 | 10.40307 | 5        | 55 | 14.01874 | 44.1726    | 0.000   | 44.1726 | 190433.076 | 607537.865 | 3.557 | 0.000   | 3.557 | 2170628  | TPSCR3_GGD | CONE      |
| m203/m002         |        | 171     | t | 20-6-2007 | 53       | 26 | 35.83732 | 5        | 55 | 45.69470 | 43.5771    | 0.000   | 43.5771 | 191025.680 | 606473.623 | 2.951 | 0.000   | 2.951 | 2170770  | TPSCR3_GGD | CONE      |
| pal1_2007         | Nes    | 187     | f | 6-7-2007  | 53       | 26 | 46.91508 | 5        | 45 | 53.01786 | 49.7114    | 0.000   | 49.7114 | 180084.123 | 606746.183 | 8.959 | 0.000   | 8.959 | 2170626  | TPSCR3_GGD | CONE      |
| pal2_2007         | Nes    | 187     | f | 6-7-2007  | 53       | 26 | 46.93934 | 5        | 45 | 53.19455 | 49.6920    | 0.000   | 49.6920 | 180087.380 | 606746.950 | 8.940 | 0.000   | 8.940 | 2170770  | TPSCR3_GGD | CONE      |
| pal3_2007         | Nes    | 187     | h | 6-7-2007  | 53       | 26 | 46.96491 | 5        | 45 | 53.38297 | 49.6907    | 0.000   | 49.6907 | 180090.854 | 606747.759 | 8.939 | 0.000   | 8.939 | 2170628  | TPSCR3_GGD | CONE      |
| pal4_2007         | Nes    | 187     | h | 6-7-2007  | 53       | 26 | 46.98782 | 5        | 45 | 53.57363 | 49.6402    | 0.000   | 49.6402 | 180094.369 | 606748.486 | 8.888 | 0.000   | 8.888 | 2170640  | TPSCR3_GGD | CONE      |

## Overview Map 2007



[illegible]

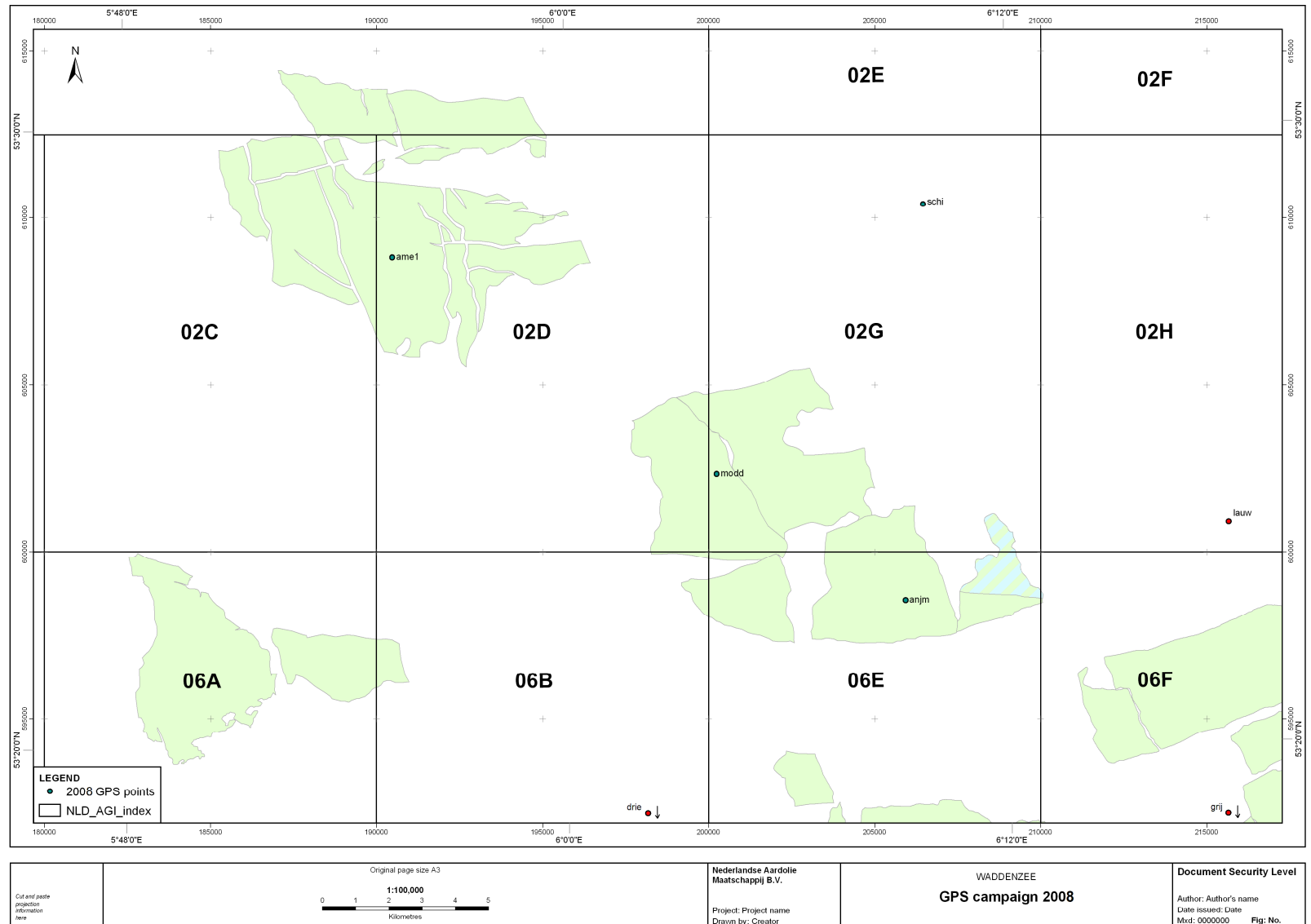
## Overview Map 2008



[illegible]



Overview Map 2008  
(Grij(pskerk) and Drie(sum) are out of map range).





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# GNSMART processing Waddenzee 2009

Operator: 06-GPS

Date: 18-12-2009

| Station | owner  | GPS day | hr    | Date | N ETRS89 (° ' ") |    |          |   | E ETRS89 (° ' ") |          | ell.h.(m) | ant.h.(m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type       |
|---------|--------|---------|-------|------|------------------|----|----------|---|------------------|----------|-----------|-----------|---------|------------|------------|-----------|-----------|---------|-------------|-----------------|
| 0687    | SAPOS  |         | fixed |      | 53               | 33 | 49.15574 | 6 | 44               | 50.78840 | 54.4101   | 0.0540    | 54.4641 | 245130.121 | 620588.003 | 14.2257   | 0.0540    | 14.2797 | 200110      | LEIAT504GG      |
| ball    | 06-GPS |         | fixed |      | 53               | 26 | 29.58829 | 5 | 41               | 15.67011 | 54.5499   | 0.1010    | 54.6509 | 174967.385 | 606186.357 | 13.7208   | 0.1010    | 13.8218 | 2170556     | TPSCR3_GGD_CONE |
| drac    | 06-GPS |         | fixed |      | 53               | 6  | 31.75455 | 6 | 4                | 58.04662 | 56.3480   | 0.1470    | 56.4950 | 201580.587 | 569339.061 | 15.0343   | 0.1470    | 15.1813 | 2170593     | TPSCR3_GGD_CONE |
| schi    | NAM    |         | fixed |      | 53               | 28 | 38.43917 | 6 | 9                | 44.16452 | 50.8109   | 0.1480    | 50.9589 | 206461.096 | 610405.714 | 10.3550   | 0.1480    | 10.5030 | 2170643     | TPSCR3_GGD_CONE |

| Station | owner | GPS day | hr    | Date | N ETRS89 (° ' ") |    |          |   | E ETRS89 (° ' ") |          | ell.h. (m) | ant.h.(m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type   |
|---------|-------|---------|-------|------|------------------|----|----------|---|------------------|----------|------------|-----------|---------|------------|------------|-----------|-----------|---------|-------------|-------------|
| ters    | AGRS  |         | fixed |      | 53               | 21 | 45.84903 | 5 | 13               | 9.78826  | 56.1008    | 0.0000    | 56.1008 | 143827.236 | 597385.498 | 14.6893   | 0.0000    | 14.6893 | 220193243   | trm29659.00 |
| wsra    | AGRS  |         | fixed |      | 52               | 54 | 52.58929 | 6 | 36               | 16.20650 | 82.2751    | 0.3890    | 82.6641 | 236880.508 | 548192.307 | 40.7251   | 0.3890    | 41.1141 | 273         | AOAD/M T    |

| Station | owner | GPS day | hr | Date     | N ETRS89 (° ' ") |    |          |   | E ETRS89 (° ' ") |          | ell.h. (m) | ant.h.(m) | ARP (m) | X-RD (m) | Y-RD (m)   | Z-NAP (m)  | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type |                 |
|---------|-------|---------|----|----------|------------------|----|----------|---|------------------|----------|------------|-----------|---------|----------|------------|------------|-----------|---------|-------------|-----------|-----------------|
| ame1    | NAM   | 248     | x  | 5-9-2009 | 53               | 27 | 51.94276 | 5 | 55               | 16.80624 | 47.9923    | 0.1480    | 48.1403 |          | 190474.975 | 608822.477 | 7.3983    | 0.1480  | 7.5463      | 2170510   | TPSCR3 GGD CONE |
| anjm    | NAM   | 248     | x  | 5-9-2009 | 53               | 22 | 15.04179 | 6 | 9                | 8.59142  | 45.2704    | 0.0000    | 45.2704 |          | 205931.141 | 598546.041 | 4.6441    | 0.0000  | 4.6441      | 2170642   | TPSCR3 GGD CONE |
| modd    | NAM   | 248     | x  | 5-9-2009 | 53               | 24 | 19.27161 | 6 | 4                | 2.98536  | 47.4157    | 0.1470    | 47.5627 |          | 200244.558 | 602329.795 | 6.8032    | 0.1470  | 6.9502      | 2170639   | TPSCR3 GGD CONE |

| Test Nes | GPS day | hr  | Date | N ETRS89 (° ' ") |    |    |          | E ETRS89 (° ' ") |    |          |         | ell.h. (m) | ant.h.(m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type       |
|----------|---------|-----|------|------------------|----|----|----------|------------------|----|----------|---------|------------|-----------|---------|------------|------------|-----------|-----------|---------|-------------|-----------------|
| pal1     | paal1   | 129 | d    | 9-5-2009         | 53 | 26 | 46.56242 | 5                | 45 | 53.19526 | 49.5317 | 0.0000     | 49.5317   |         | 180087.455 | 606735.298 | 3.7532    | 5.0263    | 8.7795  | 2170626     | TPSCR3_GGD CONE |
| pal2     | paal2   | 144 | f    | 24-5-2009        | 53 | 26 | 46.56351 | 5                | 45 | 53.19537 | 49.5267 | 0.0000     | 49.5267   |         | 180087.457 | 606735.332 | 3.7519    | 5.0226    | 8.7745  | 2170770     | TPSCR3_GGD CONE |
| pal3     | paal3   | 150 | x    | 30-5-2009        | 53 | 26 | 46.56236 | 5                | 45 | 53.19511 | 49.5261 | 0.0000     | 49.5261   |         | 180087.452 | 606735.296 | 3.7497    | 5.0242    | 8.7739  | 2170628     | TPSCR3_GGD CONE |
| pal4     | paal4   | 135 | j    | 15-5-2009        | 53 | 26 | 46.56344 | 5                | 45 | 53.19551 | 49.5255 | 0.0000     | 49.5255   |         | 180087.459 | 606735.330 | 3.7515    | 5.0218    | 8.7733  | 2170640     | TPSCR3_GGD CONE |

| Stations Waddenzee | GPS day | hr  | Date | N ETRS89 (° ' ") |    |    |         | E ETRS89 (° ' ") |    |          |         | ell.h.(m) | ant.h.(m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type       |
|--------------------|---------|-----|------|------------------|----|----|---------|------------------|----|----------|---------|-----------|-----------|---------|------------|------------|-----------|-----------|---------|-------------|-----------------|
| 689a               | 0A2689  | 174 | h    | 23-6-2009        | 53 | 23 | 6.63093 | 6                | 14 | 11.21972 | 43.9564 | 0.0000    | 43.9564   |         | 211507.513 | 600203.633 | -0.8171   | 4.2134    | 3.3963  | 2170626     | TPSCR3_GGD CONE |
| 689b               | 0A2689  | 247 | f    | 4-9-2009         | 53 | 23 | 6.63267 | 6                | 14 | 11.21930 | 43.9503 | 0.0000    | 43.9503   |         | 211507.504 | 600203.687 | -0.8172   | 4.2074    | 3.3902  | 2170770     | TPSCR3_GGD CONE |
| 689c               | 0A2689  | 208 | j    | 27-7-2009        | 53 | 23 | 6.63006 | 6                | 14 | 11.22124 | 43.9501 | 0.0000    | 43.9501   |         | 211507.541 | 600203.607 | -0.8189   | 4.2089    | 3.3900  | 2170628     | TPSCR3_GGD CONE |



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|------|---------|-----|---|-----------|----|----|----------|---|----|----------|---------|--------|---------|------------|------------|---------|--------|--------|---------|------------|------|
| 689d | 0A2689  | 188 | g | 7-7-2009  | 53 | 23 | 6.63085  | 6 | 14 | 11.22035 | 43.9503 | 0.0000 | 43.9503 | 211507.525 | 600203.631 | -0.8175 | 4.2077 | 3.3902 | 2170640 | TPSCR3_GGD | CONE |
| 2691 | 0A2691  | 267 | e | 24-9-2009 | 53 | 24 | 10.79014 | 6 | 8  | 23.90604 | 45.9762 | 0.0000 | 45.9762 | 205067.518 | 602115.621 | 0.8574  | 4.5377 | 5.3951 | 2170628 | TPSCR3_GGD | CONE |
| 4025 | 0A4025  | 222 | g | 10-8-2009 | 53 | 24 | 30.86899 | 6 | 11 | 52.37758 | 48.9481 | 0.0000 | 48.9481 | 208912.004 | 602778.200 | 6.9431  | 1.4607 | 8.4038 | 2170628 | TPSCR3_GGD | CONE |
| c028 | 002C028 | 137 | f | 17-5-2009 | 53 | 24 | 38.02328 | 5 | 53 | 34.26223 | 43.6242 | 0.0000 | 43.6242 | 188625.279 | 602813.689 | -1.1135 | 4.0194 | 2.9059 | 2170770 | TPSCR3_GGD | CONE |
| c031 | 002C031 | 139 | g | 19-5-2009 | 53 | 25 | 35.74987 | 5 | 53 | 25.67577 | 43.6617 | 0.0000 | 43.6617 | 188454.186 | 604597.205 | -1.0491 | 4.0216 | 2.9725 | 2170628 | TPSCR3_GGD | CONE |
| c035 | 002C035 | 143 | k | 23-5-2009 | 53 | 26 | 35.98731 | 5 | 53 | 21.05126 | 43.7008 | 0.0000 | 43.7008 | 188355.798 | 606458.871 | -0.9776 | 4.0202 | 3.0426 | 2170640 | TPSCR3_GGD | CONE |
| c065 | 002C065 | 130 | l | 10-5-2009 | 53 | 24 | 47.22558 | 5 | 50 | 10.25223 | 44.2235 | 0.0000 | 44.2235 | 184854.979 | 603073.174 | -0.5548 | 4.0200 | 3.4652 | 2170770 | TPSCR3_GGD | CONE |
| d050 | 002D050 | 145 | l | 25-5-2009 | 53 | 27 | 10.40373 | 5 | 55 | 14.01799 | 44.1624 | 0.0000 | 44.1624 | 190433.062 | 607537.886 | -0.4739 | 4.0211 | 3.5472 | 2170628 | TPSCR3_GGD | CONE |
| d056 | 002D056 | 141 | j | 21-5-2009 | 53 | 24 | 15.08617 | 5 | 55 | 14.02914 | 43.6896 | 0.0000 | 43.6896 | 190473.452 | 602117.906 | -1.0417 | 4.0244 | 2.9827 | 2170626 | TPSCR3_GGD | CONE |
| d061 | 002D061 | 175 | j | 24-6-2009 | 53 | 27 | 22.96369 | 6 | 3  | 42.72360 | 45.4536 | 0.0000 | 45.4536 | 199816.961 | 608005.113 | 0.9025  | 4.0197 | 4.9222 | 2170770 | TPSCR3_GGD | CONE |
| d065 | 002D065 | 156 | k | 5-6-2009  | 53 | 25 | 7.17709  | 5 | 59 | 1.71296  | 43.5730 | 0.0000 | 43.5730 | 194666.533 | 603761.358 | -1.0787 | 4.0190 | 2.9403 | 2170640 | TPSCR3_GGD | CONE |
| d068 | 002D068 | 167 | e | 16-6-2009 | 53 | 24 | 56.05760 | 5 | 57 | 6.61033  | 43.8668 | 0.0000 | 43.8668 | 192543.444 | 603400.422 | -0.8109 | 4.0183 | 3.2074 | 2170640 | TPSCR3_GGD | CONE |
| d110 | 002D110 | 186 | j | 5-7-2009  | 53 | 25 | 49.83296 | 6 | 0  | 3.69875  | 44.1661 | 0.0000 | 44.1661 | 195800.064 | 605089.708 | -0.4607 | 4.0250 | 3.5643 | 2170626 | TPSCR3_GGD | CONE |
| g044 | 002G044 | 171 | j | 20-6-2009 | 53 | 25 | 15.81001 | 6 | 6  | 8.04370  | 44.0935 | 0.0000 | 44.0935 | 202537.498 | 604100.081 | -0.4978 | 4.0209 | 3.5231 | 2170628 | TPSCR3_GGD | CONE |
| g050 | 002G050 | 169 | g | 18-6-2009 | 53 | 26 | 6.37441  | 6 | 3  | 58.89900 | 43.6912 | 0.0000 | 43.6912 | 200137.799 | 605640.154 | -0.8919 | 4.0202 | 3.1283 | 2170770 | TPSCR3_GGD | CONE |
| g126 | 002G126 | 160 | j | 9-6-2009  | 53 | 27 | 0.56397  | 6 | 8  | 32.72037 | 44.6299 | 0.0000 | 44.6299 | 205175.248 | 607365.853 | 0.1013  | 4.0207 | 4.1220 | 2170770 | TPSCR3_GGD | CONE |
| h034 | 002H034 | 207 | o | 26-7-2009 | 53 | 24 | 26.73870 | 6 | 17 | 11.87874 | 43.6060 | 0.0000 | 43.6060 | 214815.551 | 602720.663 | -0.9205 | 4.0265 | 3.1060 | 2170626 | TPSCR3_GGD | CONE |
| h037 | 002H037 | 204 | l | 23-7-2009 | 53 | 25 | 3.80578  | 6 | 19 | 15.26699 | 43.8720 | 0.0000 | 43.8720 | 217079.976 | 603895.607 | -0.6156 | 4.0199 | 3.4043 | 2170770 | TPSCR3_GGD | CONE |
| h040 | 002H040 | 182 | d | 1-7-2009  | 53 | 26 | 19.44775 | 6 | 14 | 18.02591 | 44.5082 | 0.0000 | 44.5082 | 211562.739 | 606165.937 | 0.0089  | 4.0216 | 4.0305 | 2170770 | TPSCR3_GGD | CONE |
| h044 | 002H044 | 217 | l | 5-8-2009  | 53 | 27 | 27.04864 | 6 | 15 | 1.99933  | 43.7386 | 0.0000 | 43.7386 | 212349.351 | 608265.482 | -0.7237 | 4.0195 | 3.2958 | 2170640 | TPSCR3_GGD | CONE |
| h048 | 002H048 | 210 | e | 29-7-2009 | 53 | 27 | 56.62223 | 6 | 16 | 42.47546 | 43.6996 | 0.0000 | 43.6996 | 214191.914 | 609202.368 | -0.7351 | 4.0192 | 3.2841 | 2170640 | TPSCR3_GGD | CONE |
| h059 | 002H059 | 214 | l | 2-8-2009  | 53 | 26 | 22.75442 | 6 | 18 | 27.49767 | 44.0834 | 0.0000 | 44.0834 | 216166.501 | 606324.886 | -0.3777 | 4.0204 | 3.6427 | 2170770 | TPSCR3_GGD | CONE |
| l100 | L100    | 223 | h | 11-8-2009 | 53 | 24 | 10.91458 | 6 | 11 | 6.65528  | 44.3738 | 0.0000 | 44.3738 | 208074.246 | 602151.877 | -0.6957 | 4.5105 | 3.8148 | 2170626 | TPSCR3_GGD | CONE |
| l101 | L101    | 224 | f | 12-8-2009 | 53 | 22 | 57.66072 | 6 | 11 | 11.75253 | 44.5031 | 0.0000 | 44.5031 | 208193.588 | 599888.327 | -0.7244 | 4.6377 | 3.9133 | 2170640 | TPSCR3_GGD | CONE |
| l102 | L102    | 229 | g | 17-8-2009 | 53 | 22 | 14.70332 | 6 | 10 | 55.70040 | 44.3649 | 0.0000 | 44.3649 | 207911.563 | 598557.046 | -0.7136 | 4.4672 | 3.7536 | 2170770 | TPSCR3_GGD | CONE |
| l103 | L103    | 229 | f | 17-8-2009 | 53 | 21 | 4.76407  | 6 | 13 | 24.07696 | 44.2833 | 0.0000 | 44.2833 | 210679.984 | 596426.045 | -0.8339 | 4.4960 | 3.6621 | 2170628 | TPSCR3_GGD | CONE |
| l104 | L104    | 238 | h | 26-8-2009 | 53 | 20 | 5.69698  | 6 | 13 | 56.50104 | 45.3330 | 0.0000 | 45.3330 | 211301.178 | 594607.075 | 0.3366  | 4.3522 | 4.6888 | 2170640 | TPSCR3_GGD | CONE |
| l105 | L105    | 238 | f | 26-8-2009 | 53 | 19 | 43.25969 | 6 | 12 | 49.87551 | 45.1692 | 0.0000 | 45.1692 | 210076.302 | 593899.138 | 0.2168  | 4.2872 | 4.5040 | 2170770 | TPSCR3_GGD | CONE |
| l106 | L106    | 230 | f | 18-8-2009 | 53 | 20 | 17.25390 | 6 | 11 | 20.70668 | 43.9975 | 0.0000 | 43.9975 | 208414.364 | 594931.353 | -0.9876 | 4.3234 | 3.3358 | 2170640 | TPSCR3_GGD | CONE |



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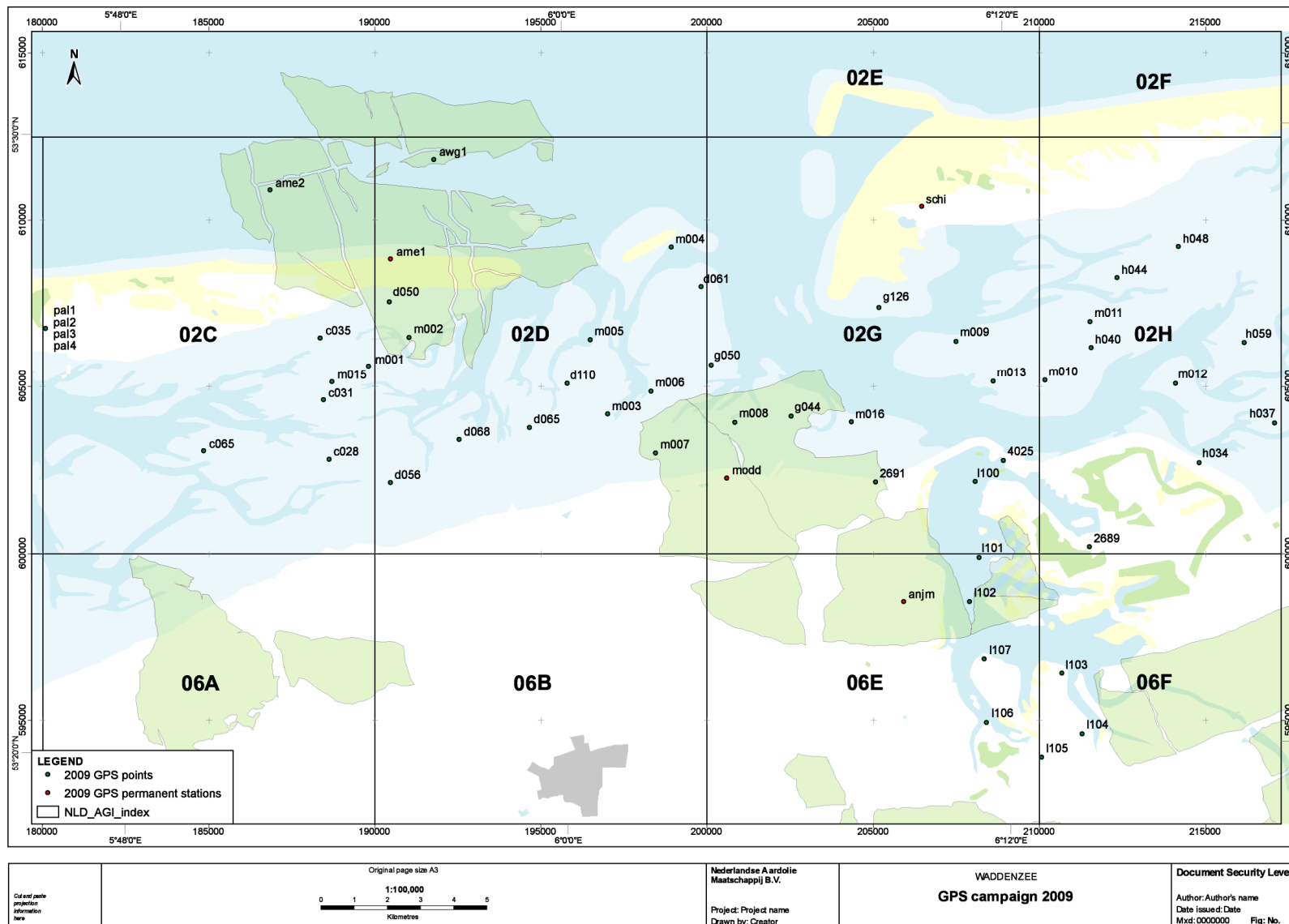
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|      |         |     |   |           |    |    |          |   |    |          |         |        |         |            |            |         |        |        |         |            |      |
|------|---------|-----|---|-----------|----|----|----------|---|----|----------|---------|--------|---------|------------|------------|---------|--------|--------|---------|------------|------|
| I107 | L107    | 230 | h | 18-8-2009 | 53 | 21 | 18.86188 | 6 | 11 | 18.39005 | 44.2628 | 0.0000 | 44.2628 | 208350.293 | 596835.415 | -0.8853 | 4.5149 | 3.6296 | 2170626 | TPSCR3_GGD | CONE |
| m001 | 002M001 | 132 | o | 12-5-2009 | 53 | 26 | 7.99580  | 5 | 54 | 39.82904 | 43.5818 | 0.0000 | 43.5818 | 189816.193 | 605603.875 | -1.0931 | 4.0202 | 2.9271 | 2170628 | TPSCR3_GGD | CONE |
| m002 | 002M002 | 149 | p | 29-5-2009 | 53 | 26 | 35.83793 | 5 | 55 | 45.69264 | 43.5727 | 0.0000 | 43.5727 | 191025.642 | 606473.642 | -1.0779 | 4.0250 | 2.9471 | 2170626 | TPSCR3_GGD | CONE |
| m003 | 002M003 | 151 | p | 31-5-2009 | 53 | 25 | 19.63198 | 6 | 1  | 9.32968  | 44.3029 | 0.0000 | 44.3029 | 197020.039 | 604166.550 | -0.3249 | 4.0206 | 3.6957 | 2170770 | TPSCR3_GGD | CONE |
| m004 | 002M004 | 198 | g | 17-7-2009 | 53 | 28 | 1.57114  | 6 | 2  | 55.13847 | 44.8055 | 0.0000 | 44.8055 | 198927.931 | 609190.515 | 0.2612  | 4.0244 | 4.2856 | 2170626 | TPSCR3_GGD | CONE |
| m005 | 002M005 | 173 | i | 22-6-2009 | 53 | 26 | 32.01686 | 6 | 0  | 41.41150 | 44.5669 | 0.0000 | 44.5669 | 196485.044 | 606399.830 | -0.0291 | 4.0192 | 3.9901 | 2170640 | TPSCR3_GGD | CONE |
| m006 | 002M006 | 179 | p | 28-6-2009 | 53 | 25 | 41.05086 | 6 | 2  | 20.20163 | 43.8162 | 0.0000 | 43.8162 | 198322.821 | 604840.404 | -0.7955 | 4.0246 | 3.2291 | 2170626 | TPSCR3_GGD | CONE |
| m007 | 002M007 | 188 | l | 7-7-2009  | 53 | 24 | 41.68915 | 6 | 2  | 26.58416 | 44.0099 | 0.0000 | 44.0099 | 198457.347 | 603006.311 | -0.6259 | 4.0207 | 3.3948 | 2170770 | TPSCR3_GGD | CONE |
| m008 | 002M008 | 184 | h | 3-7-2009  | 53 | 25 | 10.46988 | 6 | 4  | 36.11328 | 44.0706 | 0.0000 | 44.0706 | 200841.388 | 603918.409 | -0.5344 | 4.0210 | 3.4866 | 2170628 | TPSCR3_GGD | CONE |
| m009 | 002M009 | 177 | m | 26-6-2009 | 53 | 26 | 27.04036 | 6 | 10 | 37.80037 | 44.2562 | 0.0000 | 44.2562 | 207494.928 | 606354.278 | -0.2703 | 4.0212 | 3.7509 | 2170628 | TPSCR3_GGD | CONE |
| m010 | 002M010 | 195 | n | 17-7-2009 | 53 | 25 | 48.45612 | 6 | 13 | 2.08411  | 43.9209 | 0.0000 | 43.9209 | 210171.963 | 605191.455 | -0.6018 | 4.0210 | 3.4192 | 2170628 | TPSCR3_GGD | CONE |
| m011 | 002M011 | 216 | j | 4-8-2009  | 53 | 26 | 44.81295 | 6 | 14 | 16.74649 | 44.5371 | 0.0000 | 44.5371 | 211529.839 | 606949.817 | 0.0448  | 4.0250 | 4.0698 | 2170626 | TPSCR3_GGD | CONE |
| m012 | 002M012 | 202 | j | 21-7-2009 | 53 | 25 | 43.37968 | 6 | 16 | 35.19190 | 44.1863 | 0.0000 | 44.1863 | 214108.528 | 605081.546 | -0.3067 | 4.0200 | 3.7133 | 2170640 | TPSCR3_GGD | CONE |
| m013 | 002M013 | 165 | d | 14-6-2009 | 53 | 25 | 47.87692 | 6 | 11 | 37.70251 | 43.3119 | 0.0000 | 43.3119 | 208614.215 | 605155.823 | -1.2218 | 4.0201 | 2.7983 | 2170628 | TPSCR3_GGD | CONE |
| m015 | 002M015 | 134 | p | 14-5-2209 | 53 | 25 | 53.26435 | 5 | 53 | 40.02917 | 43.6742 | 0.0000 | 43.6742 | 188715.409 | 605140.532 | -1.0247 | 4.0224 | 2.9977 | 2170626 | TPSCR3_GGD | CONE |
| m016 | 002M016 | 158 | k | 7-6-2009  | 53 | 25 | 9.86371  | 6 | 7  | 45.53953 | 44.2191 | 0.0000 | 44.2191 | 204339.860 | 603934.496 | -0.3663 | 4.0247 | 3.6584 | 2170626 | TPSCR3_GGD | CONE |

| Test Grijpskerk | GPS day | hr  | Date | N ETRS89 (° ' ") |    |    |          | E ETRS89 (° ' ") |    |          |         | ell.h.(m) | ant.h.(m) | ARP (m)    | X-RD (m)   | Y-RD (m) | Z-NAP (m) | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type |
|-----------------|---------|-----|------|------------------|----|----|----------|------------------|----|----------|---------|-----------|-----------|------------|------------|----------|-----------|-----------|---------|-------------|-----------|
| gry1            | paal1   | 257 | g    | 14-9-2009        | 53 | 16 | 49.84134 | 6                | 18 | 21.62543 | 45.7164 | 0.0000    | 45.7164   | 216284.295 | 588612.726 | -0.1012  | 5.1055    | 5.0043    | 2170626 | TPSCR3_GGD  | CONE      |
| gry2            | paal2   | 257 | h    | 14-9-2009        | 53 | 16 | 50.16403 | 6                | 18 | 21.64095 | 45.7406 | 0.0000    | 45.7406   | 216284.455 | 588622.705 | -0.0990  | 5.1277    | 5.0287    | 2170770 | TPSCR3_GGD  | CONE      |
| gry3            | paal3   | 257 | h    | 14-9-2009        | 53 | 16 | 50.48794 | 6                | 18 | 21.65599 | 45.7452 | 0.0000    | 45.7452   | 216284.606 | 588632.721 | -0.1003  | 5.1338    | 5.0335    | 2170628 | TPSCR3_GGD  | CONE      |
| gry4            | paal4   | 257 | i    | 14-9-2009        | 53 | 16 | 50.81096 | 6                | 18 | 21.66844 | 45.7812 | 0.0000    | 45.7812   | 216284.709 | 588642.710 | -0.0996  | 5.1693    | 5.0697    | 2170640 | TPSCR3_GGD  | CONE      |

| Platforms |       | GPS day | hr | Date       | N ETRS89 (° ' ") |    |          |   | E ETRS89 (° ' ") |          | ell.h.(m) | ant.h.(m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type       |
|-----------|-------|---------|----|------------|------------------|----|----------|---|------------------|----------|-----------|-----------|---------|------------|------------|-----------|-----------|---------|-------------|-----------------|
| ame2      | AME-2 | 332     | m  | 28-11-2009 | 53               | 28 | 59.87228 | 5 | 52               | 0.63281  | 69.4068   | 0.0000    | 69.4068 | 186841.743 | 610897.085 | 29.0907   | -0.2833   | 28.8074 | 2170626     | TPSCR3 GGD CONE |
| awg1      | AWG-1 | 332     | x  | 28-11-2009 | 53               | 29 | 28.82936 | 5 | 56               | 28.72357 | 79.3417   | 0.0000    | 79.3417 | 191778.679 | 611827.873 | 38.7867   | 0.0216    | 38.8083 | 2170640     | TPSCR3 GGD CONE |

## Overview Map 2009





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# GNSMART processing Waddenzee 2010

Operator: 06-GPS

Date: 27-9-2010

| Station | owner  | GPSday | hr    | Date | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h.(m) | ant.h.(m) | ARP(m)  | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant.h.(m) | ARP(m)  | ser.no.ant. | ant. Type       |
|---------|--------|--------|-------|------|------------------|----|----------|------------------|----|----------|-----------|-----------|---------|------------|------------|-----------|-----------|---------|-------------|-----------------|
| 0647    | SAPOS  |        | fixed |      | 53               | 26 | 14.76816 | 7                | 1  | 38.98468 | 56.9654   | 0.054     | 57.0194 | 264005.288 | 606929.693 | 16.6301   | 0.054     | 16.6841 | 200082      | LEIAT504GG      |
| 0687    | SAPOS  |        | fixed |      | 53               | 33 | 49.15574 | 6                | 44 | 50.78840 | 54.4101   | 0.0540    | 54.4641 | 245130.121 | 620588.003 | 14.2257   | 0.0540    | 14.2797 | 200110      | LEIAT504GG      |
| ball    | 06-GPS |        | fixed |      | 53               | 26 | 29.58829 | 5                | 41 | 15.67011 | 54.5499   | 0.1010    | 54.6509 | 174967.385 | 606186.357 | 13.7208   | 0.1010    | 13.8218 | 2170556     | TPSCR3_GGD CONE |
| drac    | 06-GPS |        | fixed |      | 53               | 6  | 31.75455 | 6                | 4  | 58.04662 | 56.3480   | 0.1470    | 56.4950 | 201580.587 | 569339.061 | 15.0343   | 0.1470    | 15.1813 | 2170593     | TPSCR3_GGD CONE |
| schi    | NAM    |        | fixed |      | 53               | 28 | 38.43917 | 6                | 9  | 44.16452 | 50.8109   | 0.1480    | 50.9589 | 206461.096 | 610405.714 | 10.3550   | 0.1480    | 10.5030 | 2170643     | TPSCR3_GGD CONE |
| veen    | 06-GPS |        | fixed |      | 53               | 6  | 15.38195 | 6                | 51 | 54.03568 | 65.9274   | 0.1470    | 66.0744 | 253969.389 | 569622.677 | 24.9514   | 0.1470    | 25.0984 | 3830189     | TPSCR.G3        |

| Station | owner | GPSday | hr    | Date | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h.(m) | ant.h.(m) | ARP (m) | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant.h.(m) | ARP(m)  | ser.no.ant. | ant. Type   |
|---------|-------|--------|-------|------|------------------|----|----------|------------------|----|----------|-----------|-----------|---------|------------|------------|-----------|-----------|---------|-------------|-------------|
| ters    | AGRS  |        | fixed |      | 53               | 21 | 45.84903 | 5                | 13 | 9.78826  | 56.1008   | 0.0000    | 56.1008 | 143827.236 | 597385.498 | 14.6893   | 0.0000    | 14.6893 | 220193243   | trm29659.00 |
| wsra    | AGRS  |        | fixed |      | 52               | 54 | 52.58929 | 6                | 36 | 16.20650 | 82.2751   | 0.3890    | 82.6641 | 236880.508 | 548192.307 | 40.7251   | 0.3890    | 41.1141 | 273         | AOAD/M_T    |

| Station | owner | GPSday | hr | Date      | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h.(m) | ant.h.(m) | ARP(m)  | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type       |
|---------|-------|--------|----|-----------|------------------|----|----------|------------------|----|----------|-----------|-----------|---------|------------|------------|-----------|-----------|---------|-------------|-----------------|
| ame1    | NAM   | 243    | x  | 31-8-2010 | 53               | 27 | 51.94281 | 5                | 55 | 16.80625 | 47.9864   | 0.1480    | 48.1344 | 190474.975 | 608822.479 | 7.3924    | 0.1480    | 7.5404  | 2170510     | TPSCR3_GGD CONE |
| anjm    | NAM   | 243    | x  | 31-8-2010 | 53               | 22 | 15.04182 | 6                | 9  | 8.59136  | 45.2660   | 0.0000    | 45.2660 | 205931.140 | 598546.042 | 4.6397    | 0.0000    | 4.6397  | 2170642     | TPSCR3_GGD CONE |
| modd    | NAM   | 243    | x  | 31-8-2010 | 53               | 24 | 19.27162 | 6                | 4  | 2.98537  | 47.4122   | 0.1470    | 47.5592 | 200244.558 | 602329.795 | 6.7997    | 0.1470    | 6.9467  | 2170639     | TPSCR3_GGD CONE |

| Opstelling Nes |             | GPSday | hr | Date     | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h.(m) | ant.h.(m) | ARP(m)  | X-RD (m)   | Y-RD (m)   | Z-NAP (m) | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type       |
|----------------|-------------|--------|----|----------|------------------|----|----------|------------------|----|----------|-----------|-----------|---------|------------|------------|-----------|-----------|---------|-------------|-----------------|
| 2592           | alternatief | 213    | m  | 1-8-2010 | 53               | 26 | 46.57656 | 5                | 45 | 53.40353 | 46.6046   | 0.0000    | 46.6046 | 180091.297 | 606735.755 | 5.8524    | 0.0000    | 5.8524  | 2170765     | TPSCR3 GGD CONE |

| Stations Waddenzee |        | GPSday | hr | Date      |    | N ETRS89 (° ' ") |          |   | E ETRS89 (° ' ") |          |         | ell.h. (m) | ant.h.(m) | ARP (m)    | X-RD (m)   | Y-RD (m) | Z-NAP (m) | ant.h.(m) | ARP (m) | ser.no.ant. | ant. Type |
|--------------------|--------|--------|----|-----------|----|------------------|----------|---|------------------|----------|---------|------------|-----------|------------|------------|----------|-----------|-----------|---------|-------------|-----------|
| c012               | paal 3 | 232    | h  | 20-8-2010 | 53 | 26               | 59.80580 | 6 | 28               | 27.57664 | 44.1975 | 0.0000     | 44.1975   | 227225.793 | 607624.938 | 3.8470   | 0.0000    | 3.8470    | 2170628 | TPSCR3_GGD  | CONE      |
| c031               | paal 1 | 214    | e  | 2-8-2010  | 53 | 25               | 35.74926 | 5 | 53               | 25.67774 | 43.6651 | 0.0000     | 43.6651   | 188454.222 | 604597.186 | 2.9759   | 0.0000    | 2.9759    | 2170626 | TPSCR3_GGD  | CONE      |
| d014               | paal 2 | 234    | u  | 22-8-2010 | 53 | 27               | 53.70703 | 6 | 35               | 33.87335 | 44.3055 | 0.0000     | 44.3055   | 235064.652 | 609416.659 | 3.9938   | 0.0000    | 3.9938    | 2170770 | TPSCR3_GGD  | CONE      |
| q018               | paal 1 | 238    | c  | 26-8-2010 | 53 | 28               | 19.97262 | 6 | 46               | 49.21320 | 43.7465 | 0.0000     | 43.7465   | 247506.871 | 610453.748 | 3.4456   | 0.0000    | 3.4456    | 2170626 | TPSCR3_GGD  | CONE      |



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|      |        |     |   |           |    |    |          |   |    |          |         |        |         |            |            |        |        |        |         |            |      |
|------|--------|-----|---|-----------|----|----|----------|---|----|----------|---------|--------|---------|------------|------------|--------|--------|--------|---------|------------|------|
| g019 | paal 3 | 243 | c | 31-8-2010 | 53 | 28 | 57.60799 | 6 | 43 | 32.57632 | 43.7905 | 0.0000 | 43.7905 | 243858.511 | 611548.277 | 3.5030 | 0.0000 | 3.5030 | 2170628 | TPSCR3_GGD | CONE |
| g044 | paal 1 | 222 | l | 10-8-2010 | 53 | 25 | 15.81004 | 6 | 6  | 8.04283  | 44.0951 | 0.0000 | 44.0951 | 202537.482 | 604100.082 | 3.5247 | 0.0000 | 3.5247 | 2170626 | TPSCR3_GGD | CONE |
| m002 | paal 3 | 215 | d | 3-8-2010  | 53 | 26 | 35.83744 | 5 | 55 | 45.69364 | 43.5650 | 0.0000 | 43.5650 | 191025.661 | 606473.627 | 2.9394 | 0.0000 | 2.9394 | 2170628 | TPSCR3_GGD | CONE |
| m007 | paal 2 | 223 | m | 11-8-2010 | 53 | 24 | 41.69009 | 6 | 2  | 26.58493 | 44.0061 | 0.0000 | 44.0061 | 198457.361 | 603006.340 | 3.3910 | 0.0000 | 3.3910 | 2170770 | TPSCR3_GGD | CONE |
| m008 | paal 3 | 221 | k | 9-8-2010  | 53 | 25 | 10.46941 | 6 | 4  | 36.11241 | 44.0666 | 0.0000 | 44.0666 | 200841.372 | 603918.395 | 3.4826 | 0.0000 | 3.4826 | 2170628 | TPSCR3_GGD | CONE |
| m009 | paal 1 | 230 | f | 18-8-2010 | 53 | 26 | 27.03972 | 6 | 10 | 37.80067 | 44.2602 | 0.0000 | 44.2602 | 207494.934 | 606354.258 | 3.7549 | 0.0000 | 3.7549 | 2170626 | TPSCR3_GGD | CONE |



## Overview map 2010



GPS campaign 2010; benchmarks Waddenzee (yellow points), continuous monitoring stations (purple points) and reference stations (yellow triangles)





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#### GNSMART processing Waddenzee 2011

**Operator:** 06-GPS  
**Date:** 8-11-2011  
**RD/NAP:** RDNAPTRANS2004

| Station | owner  | status | Date      | N ETRS89 (° ' ") |    |          |   | E ETRS89 (° ' ") |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)    | Y-RD (m)    | Z-NAP (m) | ant.h. (m) | ARP (m) | ser.no.ant. | ant. Type  |      |
|---------|--------|--------|-----------|------------------|----|----------|---|------------------|----------|------------|------------|---------|-------------|-------------|-----------|------------|---------|-------------|------------|------|
| 0687    | SAPOS  | fixed  | 28-5-2011 | 53               | 33 | 49.15576 | 6 | 44               | 50.78843 | 54.4054    | 0.055      | 54.4604 | 245130.1219 | 620588.0031 | 14.2210   | 0.055      | 14.2760 | 10211024    | LEIAR25.R4 | LEIT |
| ball    | 06-GPS | fixed  | 2006      | 53               | 26 | 29.58829 | 5 | 41               | 15.67011 | 54.5499    | 0.101      | 54.6509 | 174967.3850 | 606186.3570 | 13.7208   | 0.101      | 13.8218 | 2170556     | TPSCR3_GGD | CONE |
| drac    | 06-GPS | fixed  | 27-6-2009 | 53               | 6  | 31.75455 | 6 | 4                | 58.04662 | 56.3480    | 0.147      | 56.4950 | 201580.5870 | 569339.0610 | 15.0343   | 0.147      | 15.1813 | 2170593     | TPSCR3_GGD | CONE |
| schi    | NAM    | fixed  | 2006      | 53               | 28 | 38.43917 | 6 | 9                | 44.16452 | 50.8109    | 0.148      | 50.9589 | 206461.0960 | 610405.7140 | 10.3550   | 0.148      | 10.5030 | 2170643     | TPSCR3_GGD | CONE |

| Station | owner | status | Date      | N ETRS89 (° ' ") |    |          |   | E ETRS89 (° ' ") |          |         | ell.h. (m) | ant.h. (m) | ARP (m)     | X-RD (m)    | Y-RD (m) | Z-NAP (m) | ant.h. (m) | ARP (m)   | ser.no.ant. | ant. Type |
|---------|-------|--------|-----------|------------------|----|----------|---|------------------|----------|---------|------------|------------|-------------|-------------|----------|-----------|------------|-----------|-------------|-----------|
| ters    | AGRS  | fixed  | 28-5-2011 | 53               | 21 | 45.84880 | 5 | 13               | 9.78844  | 56.1032 | 0.000      | 56.1032    | 143827.2394 | 597385.4907 | 14.6917  | 0.000     | 14.6917    | 220193243 | trm29659.00 |           |
| wsra    | AGRS  | fixed  | 2006      | 52               | 54 | 52.58929 | 6 | 36               | 16.20650 | 82.2751 | 0.389      | 82.6641    | 236880.5080 | 548192.3070 | 40.7251  | 0.389     | 41.1141    | 273       | AOAD/M_T    |           |

| Station | owner | status | Date      | N ETRS89 (° ' ") |    |          |   | E ETRS89 (° ' ") |          |         |       | ell.h. (m) | ant.h. (m)  | ARP (m)     | X-RD (m) | Y-RD (m) | Z-NAP (m) | ant.h. (m) | ARP (m)    | ser.no.ant. | ant. Type |
|---------|-------|--------|-----------|------------------|----|----------|---|------------------|----------|---------|-------|------------|-------------|-------------|----------|----------|-----------|------------|------------|-------------|-----------|
| ame1    | NAM   | mobile | 2-10-2011 | 53               | 27 | 51.94289 | 5 | 55               | 16.80618 | 47.9777 | 0.148 | 48.1257    | 190474.9737 | 608822.4812 | 7.3837   | 0.148    | 7.5317    | 2170510    | TPSCR3_GGD | CONE        |           |
| anjm    | NAM   | mobile | 2-10-2011 | 53               | 22 | 15.04185 | 6 | 9                | 8.59126  | 45.2631 | 0.000 | 45.2631    | 205931.1378 | 598546.0429 | 4.6368   | 0.000    | 4.6368    | 2170642    | TPSCR3_GGD | CONE        |           |
| modd    | NAM   | mobile | 2-10-2011 | 53               | 24 | 19.27163 | 6 | 4                | 2.98534  | 47.4097 | 0.147 | 47.5567    | 200244.5572 | 602329.7956 | 6.7972   | 0.147    | 6.9442    | 2170639    | TPSCR3_GGD | CONE        |           |

| Station | paal | status  | Date      | N ETRS89 (° ' ") |    |          |   | E ETRS89 (° ' ") |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)    | Y-RD (m)    | Z-NAP (m) | ant.h. (m) | ARP (m) | ser.no.ant. | ant. Type  |      |
|---------|------|---------|-----------|------------------|----|----------|---|------------------|----------|------------|------------|---------|-------------|-------------|-----------|------------|---------|-------------|------------|------|
| c028    | 4    | relaxed | 14-5-2011 | 53               | 24 | 38.02257 | 5 | 53               | 34.26485 | 43.6230    | 0.000      | 43.6230 | 188625.3271 | 602813.6678 | 2.9047    | 0.000      | 2.9047  | 2170640     | TPSCR3_GGD | CONE |
| c031    | 2    | relaxed | 11-5-2011 | 53               | 25 | 35.74984 | 5 | 53               | 25.67607 | 43.6615    | 0.000      | 43.6615 | 188454.1914 | 604597.2036 | 2.9723    | 0.000      | 2.9723  | 2170770     | TPSCR3_GGD | CONE |
| c035    | 4    | relaxed | 10-5-2011 | 53               | 26 | 35.98639 | 5 | 53               | 21.05121 | 43.6966    | 0.000      | 43.6966 | 188355.7973 | 606458.8424 | 3.0384    | 0.000      | 3.0384  | 2170640     | TPSCR3_GGD | CONE |
| c065    | 5    | relaxed | 9-5-2011  | 53               | 24 | 47.22528 | 5 | 50               | 10.24989 | 44.2086    | 0.000      | 44.2086 | 184854.9360 | 603073.1640 | 3.4503    | 0.000      | 3.4503  | 2170765     | TPSCR3_GGD | CONE |
| d050    | 1    | relaxed | 21-5-2011 | 53               | 27 | 10.40405 | 5 | 55               | 14.01939 | 44.1578    | 0.000      | 44.1578 | 190433.0877 | 607537.8961 | 3.5426    | 0.000      | 3.5426  | 2170626     | TPSCR3_GGD | CONE |
| d056    | 5    | relaxed | 27-5-2011 | 53               | 24 | 15.42016 | 5 | 55               | 14.01698 | 43.6671    | 0.000      | 43.6671 | 190473.1506 | 602128.2293 | 2.9604    | 0.000      | 2.9604  | 2170765     | TPSCR3_GGD | CONE |
| d068    | 2    | relaxed | 19-5-2011 | 53               | 24 | 56.05791 | 5 | 57               | 6.60716  | 43.8677    | 0.000      | 43.8677 | 192543.3849 | 603400.4307 | 3.2083    | 0.000      | 3.2083  | 2170770     | TPSCR3_GGD | CONE |



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|      |   |         |           |    |    |          |   |    |          |         |       |         |             |             |        |       |        |         |            |      |
|------|---|---------|-----------|----|----|----------|---|----|----------|---------|-------|---------|-------------|-------------|--------|-------|--------|---------|------------|------|
| d104 | 6 | relaxed | 18-5-2011 | 53 | 25 | 7.17777  | 5 | 59 | 1.71182  | 43.5595 | 0.000 | 43.5595 | 194666.5122 | 603761.3793 | 2.9268 | 0.000 | 2.9268 | 3830606 | TPSCR.G3   | TPSH |
| d110 | 6 | relaxed | 26-5-2011 | 53 | 25 | 49.83175 | 6 | 0  | 3.69703  | 44.1463 | 0.000 | 44.1463 | 195800.0324 | 605089.6706 | 3.5445 | 0.000 | 3.5445 | 3830606 | TPSCR.G3   | TPSH |
| g044 | 6 | relaxed | 8-5-2011  | 53 | 25 | 15.80968 | 6 | 6  | 8.04343  | 44.0768 | 0.000 | 44.0768 | 202537.4927 | 604100.0710 | 3.5064 | 0.000 | 3.5064 | 3830606 | TPSCR.G3   | TPSH |
| m001 | 5 | relaxed | 12-5-2011 | 53 | 26 | 7.99656  | 5 | 54 | 39.82914 | 43.5616 | 0.000 | 43.5616 | 189816.1944 | 605603.8988 | 2.9069 | 0.000 | 2.9069 | 2170765 | TPSCR3_GGD | CONE |
| m002 | 1 | relaxed | 15-5-2011 | 53 | 26 | 35.83780 | 5 | 55 | 45.69472 | 43.5683 | 0.000 | 43.5683 | 191025.6805 | 606473.6382 | 2.9427 | 0.000 | 2.9427 | 2170626 | TPSCR3_GGD | CONE |
| m003 | 3 | relaxed | 21-5-2011 | 53 | 25 | 19.63214 | 6 | 1  | 9.33164  | 44.2983 | 0.000 | 44.2983 | 197020.0749 | 604166.5553 | 3.6911 | 0.000 | 3.6911 | 2170628 | TPSCR3_GGD | CONE |
| m005 | 1 | relaxed | 28-5-2011 | 53 | 26 | 32.01504 | 6 | 0  | 41.41211 | 44.5689 | 0.000 | 44.5689 | 196485.0552 | 606399.7733 | 3.9921 | 0.000 | 3.9921 | 2170626 | TPSCR3_GGD | CONE |
| m006 | 4 | relaxed | 2-6-2011  | 53 | 25 | 41.05076 | 6 | 2  | 20.20189 | 43.8064 | 0.000 | 43.8064 | 198322.8260 | 604840.4005 | 3.2193 | 0.000 | 3.2193 | 2170640 | TPSCR3_GGD | CONE |
| m007 | 3 | relaxed | 1-6-2011  | 53 | 24 | 41.68865 | 6 | 2  | 26.58515 | 44.0031 | 0.000 | 44.0031 | 198457.3654 | 603006.2953 | 3.3880 | 0.000 | 3.3880 | 2170628 | TPSCR3_GGD | CONE |
| m008 | 2 | relaxed | 31-5-2011 | 53 | 25 | 10.47039 | 6 | 4  | 36.11382 | 44.0640 | 0.000 | 44.0640 | 200841.3981 | 603918.4250 | 3.4800 | 0.000 | 3.4800 | 2170770 | TPSCR3_GGD | CONE |
| m009 | 4 | relaxed | 23-5-2011 | 53 | 26 | 27.03991 | 6 | 10 | 37.79995 | 44.2542 | 0.000 | 44.2542 | 207494.9204 | 606354.2639 | 3.7489 | 0.000 | 3.7489 | 2170640 | TPSCR3_GGD | CONE |
| m015 | 3 | relaxed | 13-5-2011 | 53 | 25 | 53.26473 | 5 | 53 | 40.02840 | 43.6678 | 0.000 | 43.6678 | 188715.3948 | 605140.5434 | 2.9913 | 0.000 | 2.9913 | 2170628 | TPSCR3_GGD | CONE |

| Station | paal | status  | Date      | N ETRS89 (° ' ") |    |          |   | E ETRS89 (° ' ") |          |         |       | ell.h. (m) | ant.h. (m)  | ARP (m)     | X-RD (m) | Y-RD (m) | Z-NAP (m) | ant.h. (m) | ARP (m)    | ser.no.ant. | ant. Type |
|---------|------|---------|-----------|------------------|----|----------|---|------------------|----------|---------|-------|------------|-------------|-------------|----------|----------|-----------|------------|------------|-------------|-----------|
| ame2    |      | relaxed | 2-10-2011 | 53               | 28 | 59.89314 | 5 | 52               | 0.69913  | 69.5875 | 0.000 | 69.5875    | 186842.9615 | 610897.7378 | 28.9881  | 0.000    | 28.9881   | 2170765    | TPSCR3_GGD | CONE        |           |
| awg1    |      | relaxed | 1-10-2011 | 53               | 29 | 28.82911 | 5 | 56               | 28.72317 | 79.3460 | 0.000 | 79.3460    | 191778.6719 | 611827.8655 | 38.8126  | 0.000    | 38.8126   | 2170626    | TPSCR3_GGD | CONE        |           |
| lunn    | 5    | relaxed | 28-9-2011 | 53               | 19 | 2.62848  | 6 | 10               | 18.13832 | 45.4231 | 0.000 | 45.4231    | 207281.8272 | 592611.6470 | 4.7133   | 0.000    | 4.7133    | 2170640    | TPSCR3_GGD | CONE        |           |
| noor    | 1    | relaxed | 21-9-2011 | 53               | 23 | 31.83483 | 6 | 18               | 23.05964 | 51.2040 | 0.000 | 51.2040    | 216152.1547 | 601039.9872 | 10.6912  | 0.000    | 10.6912   | 2170628    | TPSCR3_GGD | CONE        |           |
| sbb_    | 5    | relaxed | 21-9-2011 | 53               | 23 | 6.63105  | 6 | 14               | 8.16920  | 45.0161 | 0.000 | 45.0161    | 211451.1315 | 600202.9718 | 4.4555   | 0.000    | 4.4555    | 2170640    | TPSCR3_GGD | CONE        |           |
| spui    | 6    | relaxed | 28-9-2011 | 53               | 24 | 30.84345 | 6 | 11               | 52.76015 | 48.4052 | 0.000 | 48.4052    | 208919.0804 | 602777.4905 | 7.8610   | 0.000    | 7.8610    | 2170770    | TPSCR3_GGD | CONE        |           |
| wett    | 6    | relaxed | 21-9-2011 | 53               | 24 | 10.88609 | 6 | 8                | 23.99692 | 45.7640 | 0.000 | 45.7640    | 205069.1659 | 602118.6052 | 5.1829   | 0.000    | 5.1829    | 2170770    | TPSCR3_GGD | CONE        |           |
| zout    | 1    | relaxed | 28-9-2011 | 53               | 19 | 48.15246 | 6 | 17               | 10.99237 | 50.2708 | 0.000 | 50.2708    | 214906.8170 | 594108.3407 | 9.6463   | 0.000    | 9.6463    | 2170628    | TPSCR3_GGD | CONE        |           |

## Overview map 2011



GPS campaign 2011; benchmarks Waddenzee (yellow points), continuous monitoring stations (purple points) and reference stations (yellow triangles)



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# GNSMART processing Waddenzee 2012

Operator: 06-GPS

Date: 27-06-2012

RD/NAP: RDNAPTRANS2004

Remark:

Station G044 is inaccurate because of only 10 hours GPS data

| Station | owner  | status | Date      | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)    | Y-RD (m)    | NAP(m)  | ant.h.(m) | ARP(m)  | ser.no.ant. | ant. Type   |      |
|---------|--------|--------|-----------|------------------|----|----------|------------------|----|----------|------------|------------|---------|-------------|-------------|---------|-----------|---------|-------------|-------------|------|
| 0647    | SAPOS  | fixed  | 2-6-2012  | 53               | 20 | 14.76809 | 7                | 1  | 38.98431 | 56.9572    | 0.0550     | 57.0122 | 264259.0449 | 595802.0431 | 16.4610 | 0.0550    | 16.5160 | 10211016    | LEIAR25.R4  | LEIT |
| 0687    | SAPOS  | fixed  | 28-5-2011 | 53               | 33 | 49.15576 | 6                | 44 | 50.78843 | 54.4054    | 0.0550     | 54.4604 | 245130.1219 | 620588.0031 | 14.2210 | 0.0550    | 14.2760 | 10211024    | LEIAR25.R4  | LEIT |
| ball    | 06-GPS | fixed  | 2006      | 53               | 26 | 29.58829 | 5                | 41 | 15.67011 | 54.5499    | 0.1010     | 54.6509 | 174967.3850 | 606186.3570 | 13.7208 | 0.1010    | 13.8218 | 2170556     | TPSCR3_GGD  | CONE |
| drac    | 06-GPS | fixed  | 2-6-2012  | 53               | 6  | 31.75461 | 6                | 4  | 58.04664 | 56.3471    | 0.1470     | 56.4941 | 201580.5878 | 569339.0630 | 15.0334 | 0.1470    | 15.1804 | 2170593     | TPSCR3_GGD  | CONE |
| schi    | NAM    | fixed  | 2006      | 53               | 28 | 38.43917 | 6                | 9  | 44.16452 | 50.8109    | 0.1480     | 50.9589 | 206461.0960 | 610405.7140 | 10.3550 | 0.1480    | 10.5030 | 2170643     | TPSCR3_GGD  | CONE |
| ters    | AGRS   | fixed  | 28-5-2011 | 53               | 21 | 45.84880 | 5                | 13 | 9.78844  | 56.1032    | 0.0000     | 56.1032 | 143827.2394 | 597385.4907 | 14.6917 | 0.0000    | 14.6917 | 220193243   | trm29659.00 |      |
| veen    | 06-GPS | fixed  | 2-6-2012  | 53               | 6  | 15.38207 | 6                | 51 | 54.03545 | 65.9170    | 0.1470     | 66.064  | 253969.3844 | 569622.6805 | 24.9410 | 0.1470    | 25.0880 | 3830189     | TPSCR.G3    | TPSH |
| wsra    | AGRS   | fixed  | 2006      | 52               | 54 | 52.58929 | 6                | 36 | 16.20650 | 82.2751    | 0.3890     | 82.6641 | 236880.5080 | 548192.3070 | 40.7251 | 0.3890    | 41.1141 | 273         | AOAD/M_T    |      |

| Station | owner | status | Date     | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)    | Y-RD (m)    | NAP(m) | ant.h.(m) | ARP(m) | ser.no.ant. | ant. Type  |      |
|---------|-------|--------|----------|------------------|----|----------|------------------|----|----------|------------|------------|---------|-------------|-------------|--------|-----------|--------|-------------|------------|------|
| ame1    | NAM   | mobile | 2-6-2012 | 53               | 27 | 51.94291 | 5                | 55 | 16.80625 | 47.9750    | 0.1480     | 48.1230 | 190474.9750 | 608822.4818 | 7.3810 | 0.1480    | 7.5290 | 2170510     | TPSCR3_GGD | CONE |
| anjm    | NAM   | mobile | 2-6-2012 | 53               | 22 | 15.04185 | 6                | 9  | 8.59128  | 45.2608    | 0.0000     | 45.2608 | 205931.1382 | 598546.0429 | 4.6345 | 0.0000    | 4.6345 | 2170642     | TPSCR3_GGD | CONE |
| modd    | NAM   | mobile | 2-6-2012 | 53               | 24 | 19.27163 | 6                | 4  | 2.98536  | 47.4073    | 0.1470     | 47.5543 | 200244.5576 | 602329.7956 | 6.7948 | 0.1470    | 6.9418 | 2170639     | TPSCR3_GGD | CONE |

| Station | name     | status  | Date      | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)    | Y-RD (m)    | NAP(m) | ant.h.(m) | ARP(m) | ser.no.ant. | ant. Type  |      |
|---------|----------|---------|-----------|------------------|----|----------|------------------|----|----------|------------|------------|---------|-------------|-------------|--------|-----------|--------|-------------|------------|------|
| C124    | 003C0124 | relaxed | 31-5-2012 | 53               | 26 | 59.80665 | 6                | 28 | 27.57580 | 44.1996    | 0.000      | 44.1996 | 227225.7774 | 607624.9636 | 3.8491 | 0.000     | 3.8491 | 2170770     | TPSCR3_GGD | CONE |
| D061    | 002D0061 | relaxed | 23-5-2012 | 53               | 27 | 22.96231 | 6                | 3  | 42.72312 | 45.4554    | 0.000      | 45.4554 | 199816.9523 | 608005.0701 | 4.9240 | 0.000     | 4.9240 | 2170626     | TPSCR3_GGD | CONE |
| D140    | 003D0140 | relaxed | 6-6-2012  | 53               | 27 | 53.70611 | 6                | 35 | 33.87378 | 44.2925    | 0.000      | 44.2925 | 235064.6604 | 609416.6306 | 3.9808 | 0.000     | 3.9808 | 3830606     | TPSCR.G3   | TPSH |
| G044    | 002G0044 | relaxed | 4-6-2012  | 53               | 25 | 15.81000 | 6                | 6  | 8.04332  | 44.0681    | 0.000      | 44.0681 | 202537.4906 | 604100.0809 | 3.4977 | 0.000     | 3.4977 | 2170765     | TPSCR3_GGD | CONE |
| G050    | 002G0050 | relaxed | 18-5-2012 | 53               | 26 | 6.37391  | 6                | 3  | 58.98887 | 43.6861    | 0.000      | 43.6861 | 200137.7964 | 605640.1381 | 3.1232 | 0.000     | 3.1232 | 2170640     | TPSCR3_GGD | CONE |
| G126    | 002G0126 | relaxed | 20-5-2012 | 53               | 27 | 0.56245  | 6                | 8  | 32.72046 | 44.6281    | 0.000      | 44.6281 | 205175.2500 | 607365.8057 | 4.1202 | 0.000     | 4.1202 | 2170628     | TPSCR3_GGD | CONE |
| G189    | 003G0189 | relaxed | 24-5-2012 | 53               | 28 | 19.97376 | 6                | 46 | 49.21183 | 43.7228    | 0.000      | 43.7228 | 247506.8450 | 610453.7826 | 3.4219 | 0.000     | 3.4219 | 3830606     | TPSCR.G3   | TPSH |





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|------|----------|---------|-----------|----|----|----------|---|----|----------|---------|-------|---------|-------------|-------------|--------|-------|--------|---------|------------|------|
| G198 | 003G0198 | relaxed | 24-5-2012 | 53 | 28 | 57.60901 | 6 | 43 | 32.57656 | 43.7868 | 0.000 | 43.7868 | 243858.5152 | 611548.3090 | 3.4993 | 0.000 | 3.4993 | 2170770 | TPSCR3_GGD | CONE |
| H034 | 002H0034 | relaxed | 11-5-2012 | 53 | 24 | 26.73909 | 6 | 17 | 11.87916 | 43.5994 | 0.000 | 43.5994 | 214815.5582 | 602720.6748 | 3.0994 | 0.000 | 3.0994 | 2170770 | TPSCR3_GGD | CONE |
| H037 | 002H0037 | relaxed | 12-5-2012 | 53 | 25 | 3.80600  | 6 | 19 | 15.26441 | 43.8761 | 0.000 | 43.8761 | 217079.9278 | 603895.6131 | 3.4084 | 0.000 | 3.4084 | 2170626 | TPSCR3_GGD | CONE |
| H040 | 002H0040 | relaxed | 4-6-2012  | 53 | 26 | 19.44949 | 6 | 14 | 18.02504 | 44.5047 | 0.000 | 44.5047 | 211562.7222 | 606165.9910 | 4.0270 | 0.000 | 4.0270 | 2170640 | TPSCR3_GGD | CONE |
| H044 | 002H0044 | relaxed | 9-5-2012  | 53 | 27 | 27.04841 | 6 | 15 | 1.99852  | 43.7380 | 0.000 | 43.7380 | 212349.3360 | 608265.4747 | 3.2952 | 0.000 | 3.2952 | 2170640 | TPSCR3_GGD | CONE |
| H048 | 002H0048 | relaxed | 10-5-2012 | 53 | 27 | 56.62153 | 6 | 16 | 42.47496 | 43.7022 | 0.000 | 43.7022 | 214191.9048 | 609202.3464 | 3.2867 | 0.000 | 3.2867 | 2170628 | TPSCR3_GGD | CONE |
| H059 | 002H0059 | relaxed | 1-6-2012  | 53 | 26 | 22.75444 | 6 | 18 | 27.49808 | 44.0903 | 0.000 | 44.0903 | 216166.5080 | 606324.8867 | 3.6496 | 0.000 | 3.6496 | 2170626 | TPSCR3_GGD | CONE |
| M003 | M003Z    | relaxed | 27-5-2012 | 53 | 25 | 19.63127 | 6 | 1  | 9.33189  | 44.2949 | 0.000 | 44.2949 | 197020.0797 | 604166.5284 | 3.6877 | 0.000 | 3.6877 | 2170640 | TPSCR3_GGD | CONE |
| M004 | M004Z    | relaxed | 31-5-2012 | 53 | 28 | 1.57125  | 6 | 2  | 55.13898 | 44.8009 | 0.000 | 44.8009 | 198927.9403 | 609190.5186 | 4.2810 | 0.000 | 4.2810 | 2170628 | TPSCR3_GGD | CONE |
| M006 | M006Z    | relaxed | 25-5-2012 | 53 | 25 | 41.05055 | 6 | 2  | 20.20013 | 43.7887 | 0.000 | 43.7887 | 198322.7936 | 604840.3938 | 3.2016 | 0.000 | 3.2016 | 2170765 | TPSCR3_GGD | CONE |
| M007 | M007Z    | relaxed | 9-6-2012  | 53 | 24 | 41.68889 | 6 | 2  | 26.58467 | 43.9981 | 0.000 | 43.9981 | 198457.3565 | 603006.3027 | 3.3830 | 0.000 | 3.3830 | 2170628 | TPSCR3_GGD | CONE |
| M008 | M008Z    | relaxed | 3-6-2012  | 53 | 25 | 10.46974 | 6 | 4  | 36.11417 | 44.0427 | 0.000 | 44.0427 | 200841.4048 | 603918.4050 | 3.4587 | 0.000 | 3.4587 | 2170765 | TPSCR3_GGD | CONE |
| M009 | M009Z    | relaxed | 7-5-2012  | 53 | 26 | 27.04049 | 6 | 10 | 37.80064 | 44.2428 | 0.000 | 44.2428 | 207494.9329 | 606354.2820 | 3.7375 | 0.000 | 3.7375 | 3830606 | TPSCR.G3   | TPSH |
| M010 | M0010Z   | relaxed | 18-5-2012 | 53 | 25 | 48.45502 | 6 | 13 | 2.08169  | 43.9020 | 0.000 | 43.9020 | 210171.9190 | 605191.4202 | 3.4003 | 0.000 | 3.4003 | 2170765 | TPSCR3_GGD | CONE |
| M011 | M0011Z   | relaxed | 8-5-2012  | 53 | 26 | 44.81191 | 6 | 14 | 16.74609 | 44.5138 | 0.000 | 44.5138 | 211529.8319 | 606949.7849 | 4.0465 | 0.000 | 4.0465 | 2170765 | TPSCR3_GGD | CONE |
| M012 | M0012Z   | relaxed | 17-5-2012 | 53 | 25 | 43.37957 | 6 | 16 | 35.19203 | 44.1880 | 0.000 | 44.1880 | 214108.5308 | 605081.5426 | 3.7150 | 0.000 | 3.7150 | 2170770 | TPSCR3_GGD | CONE |
| M013 | M0013Z   | relaxed | 12-5-2012 | 53 | 25 | 47.87507 | 6 | 11 | 37.70100 | 43.2983 | 0.000 | 43.2983 | 208614.1880 | 605155.7658 | 2.7847 | 0.000 | 2.7847 | 3830606 | TPSCR.G3   | TPSH |
| M016 | M0016Z   | relaxed | 9-6-2012  | 53 | 25 | 9.86422  | 6 | 7  | 45.54011 | 44.2072 | 0.000 | 44.2072 | 204339.8701 | 603934.5118 | 3.6465 | 0.000 | 3.6465 | 2170640 | TPSCR3_GGD | CONE |

| Station | name | status  | Date      | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)    | Y-RD (m)    | NAP(m) | ant.h.(m) | ARP(m) | ser.no.ant. | ant. Type  |      |
|---------|------|---------|-----------|------------------|----|----------|------------------|----|----------|------------|------------|---------|-------------|-------------|--------|-----------|--------|-------------|------------|------|
| L100    | L100 | relaxed | 18-6-2012 | 53               | 24 | 10.90955 | 6                | 11 | 6.92499  | 44.3332    | 0.000      | 44.3332 | 208079.2305 | 602151.7769 | 3.7742 | 0.000     | 3.7742 | 3830606     | TPSCR.G3   | TPSH |
| L101    | L101 | relaxed | 18-6-2012 | 53               | 22 | 57.81332 | 6                | 11 | 11.72220 | 44.2655    | 0.000      | 44.2655 | 208192.9753 | 599893.0379 | 3.6757 | 0.000     | 3.6757 | 2170640     | TPSCR3_GGD | CONE |
| L102    | L102 | relaxed | 19-6-2012 | 53               | 22 | 14.60784 | 6                | 10 | 55.56048 | 44.5302    | 0.000      | 44.5302 | 207909.0090 | 598554.0655 | 3.9189 | 0.000     | 3.9189 | 2170770     | TPSCR3_GGD | CONE |
| L103    | L103 | relaxed | 19-6-2012 | 53               | 21 | 4.44789  | 6                | 13 | 24.09222 | 44.3300    | 0.000      | 44.3300 | 210680.3800 | 596416.2742 | 3.7086 | 0.000     | 3.7086 | 2170628     | TPSCR3_GGD | CONE |
| L104    | L104 | relaxed | 27-6-2012 | 53               | 20 | 5.62915  | 6                | 13 | 56.19271 | 45.3505    | 0.000      | 45.3505 | 211295.4969 | 594604.9110 | 4.7063 | 0.000     | 4.7063 | 2170626     | TPSCR3_GGD | CONE |
| L105    | L105 | relaxed | 27-6-2012 | 53               | 19 | 43.08487 | 6                | 12 | 49.77848 | 45.3736    | 0.000      | 45.3736 | 210074.5679 | 593893.7125 | 4.7083 | 0.000     | 4.7083 | 2170770     | TPSCR3_GGD | CONE |
| L106    | L106 | relaxed | 20-6-2012 | 53               | 20 | 17.30394 | 6                | 11 | 20.49730 | 44.0797    | 0.000      | 44.0797 | 208410.4729 | 594932.8566 | 3.4180 | 0.000     | 3.4180 | 2170765     | TPSCR3_GGD | CONE |
| L107    | L107 | relaxed | 19-6-2012 | 53               | 21 | 18.87946 | 6                | 11 | 18.29067 | 44.1524    | 0.000      | 44.1524 | 208348.4484 | 596835.9378 | 3.5192 | 0.000     | 3.5192 | 2170626     | TPSCR3_GGD | CONE |

## Overview map 2012



GPS campaign 2012; benchmarks Waddenzee (yellow points), continuous monitoring stations (purple points) and reference stations (yellow triangles)



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#### GNSMART processing Waddenzee 2013

Operator: 06-GPS  
Date: 25-05-2013  
RD/NAP: RDNAPTRANS2004

| Station | owner  | status | Date      | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)   | Y-RD (m)   | NAP(m) | ant.h.(m) | ARP(m) | ser.no.ant. | ant. Type   |      |
|---------|--------|--------|-----------|------------------|----|----------|------------------|----|----------|------------|------------|---------|------------|------------|--------|-----------|--------|-------------|-------------|------|
| 0647    | SAPOS  | fixed  | 1-6-2013  | 53               | 20 | 14.76812 | 7                | 1  | 38.98408 | 56.9572    | 0.0550     | 57.0122 | 264259.041 | 595802.044 | 16.461 | 0.055     | 16.516 | 10211016    | LEIAR25.R4  | LEIT |
| 0687    | SAPOS  | fixed  | 28-5-2011 | 53               | 33 | 49.15576 | 6                | 44 | 50.78843 | 54.4054    | 0.0550     | 54.4604 | 245130.122 | 620588.003 | 14.221 | 0.055     | 14.276 | 10211024    | LEIAR25.R4  | LEIT |
| ball    | 06-GPS | fixed  | 2006      | 53               | 26 | 29.58829 | 5                | 41 | 15.67011 | 54.5499    | 0.1010     | 54.6509 | 174967.385 | 606186.357 | 13.721 | 0.101     | 13.822 | 2170556     | TPSCR3_GGD  | CONE |
| drac    | 06-GPS | fixed  | 1-6-2013  | 53               | 6  | 31.75472 | 6                | 4  | 58.04659 | 56.3471    | 0.1470     | 56.4941 | 201580.587 | 569339.066 | 15.033 | 0.147     | 15.180 | 2170593     | TPSCR3_GGD  | CONE |
| schi    | NAM    | fixed  | 2006      | 53               | 28 | 38.43917 | 6                | 9  | 44.16452 | 50.8109    | 0.1480     | 50.9589 | 206461.096 | 610405.714 | 10.355 | 0.148     | 10.503 | 2170643     | TPSCR3_GGD  | CONE |
| ters    | AGRS   | fixed  | 28-5-2011 | 53               | 21 | 45.84880 | 5                | 13 | 9.78844  | 56.1032    | 0.0000     | 56.1032 | 143827.239 | 597385.490 | 14.692 | 0.000     | 14.692 | 220193243   | trm29659.00 |      |
| wsra    | AGRS   | fixed  | 2006      | 52               | 54 | 52.58952 | 6                | 36 | 16.20634 | 82.2751    | 0.3890     | 82.6641 | 236880.505 | 548192.313 | 40.725 | 0.389     | 41.114 | 273         | AOAD/M_T    |      |

| Station | owner | status | Date     | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)   | Y-RD (m)   | NAP(m) | ant.h.(m) | ARP(m) | ser.no.ant. | ant. Type  |      |
|---------|-------|--------|----------|------------------|----|----------|------------------|----|----------|------------|------------|---------|------------|------------|--------|-----------|--------|-------------|------------|------|
| ame1    | NAM   | mobile | 1-6-2013 | 53               | 27 | 51.94297 | 5                | 55 | 16.80627 | 47.9691    | 0.1480     | 48.1171 | 190474.975 | 608822.483 | 7.375  | 0.148     | 7.523  | 2170510     | TPSCR3_GGD | CONE |
| anjm    | NAM   | mobile | 1-6-2013 | 53               | 22 | 15.04189 | 6                | 9  | 8.59121  | 45.2577    | 0.0000     | 45.2577 | 205931.137 | 598546.044 | 4.631  | 0.000     | 4.631  | 2170642     | TPSCR3_GGD | CONE |
| modd    | NAM   | mobile | 1-6-2013 | 53               | 24 | 19.27163 | 6                | 4  | 2.98533  | 47.4022    | 0.1470     | 47.5492 | 200244.557 | 602329.795 | 6.790  | 0.147     | 6.937  | 2170639     | TPSCR3_GGD | CONE |
| tenp    | NAM   | mobile | 1-6-2013 | 53               | 17 | 57.24969 | 6                | 44 | 40.74112 | 47.6573    | 0.1480     | 47.8053 | 245500.603 | 591158.827 | 7.107  | 0.148     | 7.255  | 762-10980   | TPSCR.G5   | TPSH |
| veen    | NAM   | mobile | 1-6-2013 | 53               | 6  | 15.38219 | 6                | 51 | 54.03528 | 65.9142    | 0.1470     | 66.0612 | 253969.381 | 569622.684 | 24.938 | 0.147     | 25.085 | 3830189     | TPSCR.G3   | TPSH |

| Station | name      | status  | Date      | N ETRS89 (° ' ") |    |          | E ETRS89 (° ' ") |    |          | ell.h. (m) | ant.h. (m) | ARP (m) | X-RD (m)   | Y-RD (m)   | NAP(m) | ant.h.(m) | ARP(m) | ser.no.ant. | ant. Type  |      |
|---------|-----------|---------|-----------|------------------|----|----------|------------------|----|----------|------------|------------|---------|------------|------------|--------|-----------|--------|-------------|------------|------|
| C031    | 002C0031  | relaxed | 12-5-2013 | 53               | 25 | 35.74965 | 5                | 53 | 25.67788 | 43.6592    | 0.000      | 43.6592 | 188454.225 | 604597.198 | 2.970  | 0.000     | 2.970  | 2170770     | TPSCR3_GGD | CONE |
| C035    | 002C0035  | relaxed | 25-5-2013 | 53               | 26 | 35.98771 | 5                | 53 | 21.05156 | 43.6801    | 0.000      | 43.6801 | 188355.803 | 606458.883 | 3.022  | 0.000     | 3.022  | 3830606     | TPSCR.G3   | TPSH |
| C124    | 003C0124  | relaxed | 15-5-2013 | 53               | 26 | 59.80521 | 6                | 28 | 27.57801 | 44.1964    | 0.000      | 44.1964 | 227225.819 | 607624.919 | 3.846  | 0.000     | 3.846  | 2170628     | TPSCR3_GGD | CONE |
| D068    | 002D0068  | relaxed | 19-5-2013 | 53               | 24 | 56.05794 | 5                | 57 | 6.60909  | 43.8650    | 0.000      | 43.8650 | 192543.421 | 603400.432 | 3.206  | 0.000     | 3.206  | 2170770     | TPSCR3_GGD | CONE |
| D140    | 003D 0140 | relaxed | 21-5-2013 | 53               | 27 | 53.70582 | 6                | 35 | 33.87422 | 44.3014    | 0.000      | 44.3014 | 235064.669 | 609416.621 | 3.990  | 0.000     | 3.990  | 2170628     | TPSCR3_GGD | CONE |
| G044    | 002G0044  | relaxed | 16-5-2013 | 53               | 25 | 15.81040 | 6                | 6  | 8.04168  | 44.0665    | 0.000      | 44.0665 | 202537.460 | 604100.093 | 3.496  | 0.000     | 3.496  | 2170765     | TPSCR3_GGD | CONE |





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|      |          |         |           |    |    |          |   |    |          |         |       |         |            |            |       |       |       |         |            |      |
|------|----------|---------|-----------|----|----|----------|---|----|----------|---------|-------|---------|------------|------------|-------|-------|-------|---------|------------|------|
| G189 | 003G0189 | relaxed | 15-5-2013 | 53 | 28 | 19.97245 | 6 | 46 | 49.21369 | 43.7315 | 0.000 | 43.7315 | 247506.880 | 610453.742 | 3.431 | 0.000 | 3.431 | 2170640 | TPSCR3_GGD | CONE |
| G198 | 003G0198 | relaxed | 19-5-2013 | 53 | 28 | 57.60832 | 6 | 43 | 32.57583 | 43.7835 | 0.000 | 43.7835 | 243858.502 | 611548.287 | 3.496 | 0.000 | 3.496 | 2170640 | TPSCR3_GGD | CONE |
| M007 | M007z    | relaxed | 24-5-2013 | 53 | 24 | 41.68955 | 6 | 2  | 26.58478 | 43.9785 | 0.000 | 43.9785 | 198457.358 | 603006.323 | 3.363 | 0.000 | 3.363 | 2170765 | TPSCR3_GGD | CONE |
| M008 | M008z    | relaxed | 17-5-2013 | 53 | 25 | 10.47007 | 6 | 4  | 36.11284 | 44.0430 | 0.000 | 44.0430 | 200841.380 | 603918.415 | 3.459 | 0.000 | 3.459 | 3830606 | TPSCR.G3   | TPSH |
| M009 | M009z    | relaxed | 12-5-2013 | 53 | 26 | 27.04085 | 6 | 10 | 37.80062 | 44.2571 | 0.000 | 44.2571 | 207494.932 | 606354.293 | 3.752 | 0.000 | 3.752 | 2170626 | TPSCR3_GGD | CONE |
| M011 | M0011z   | relaxed | 18-5-2013 | 53 | 26 | 44.81238 | 6 | 14 | 16.74745 | 44.5335 | 0.000 | 44.5335 | 211529.857 | 606949.799 | 4.066 | 0.000 | 4.066 | 2170626 | TPSCR3_GGD | CONE |

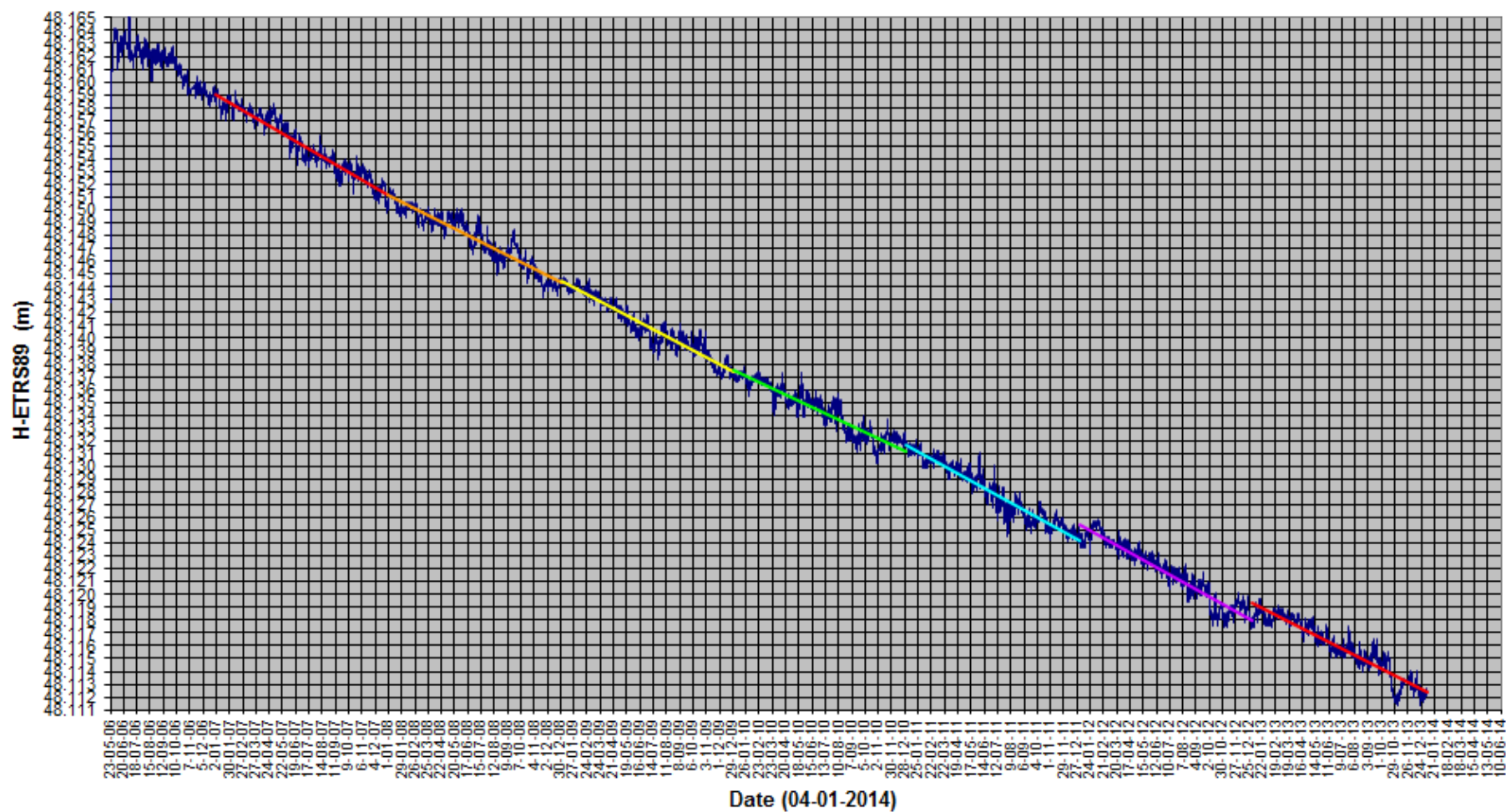
## Overview map 2013



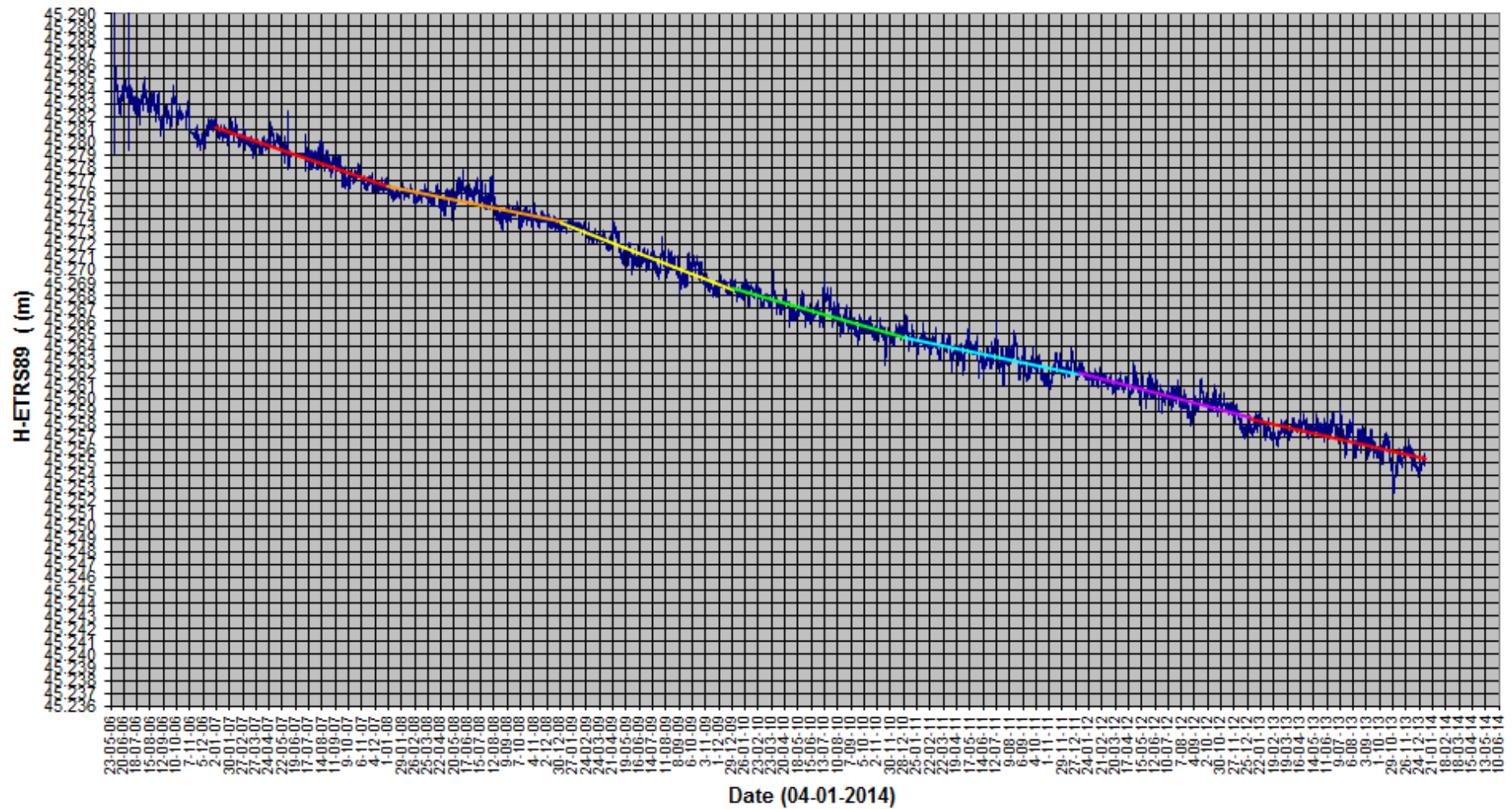
*GPS campaign 2013; benchmarks Waddenzee (yellow points), continuous monitoring stations (purple points) and reference stations (yellow triangles)*

## APPENDIX III: GNSMART results Monitor Stations on land 2006 - 2013

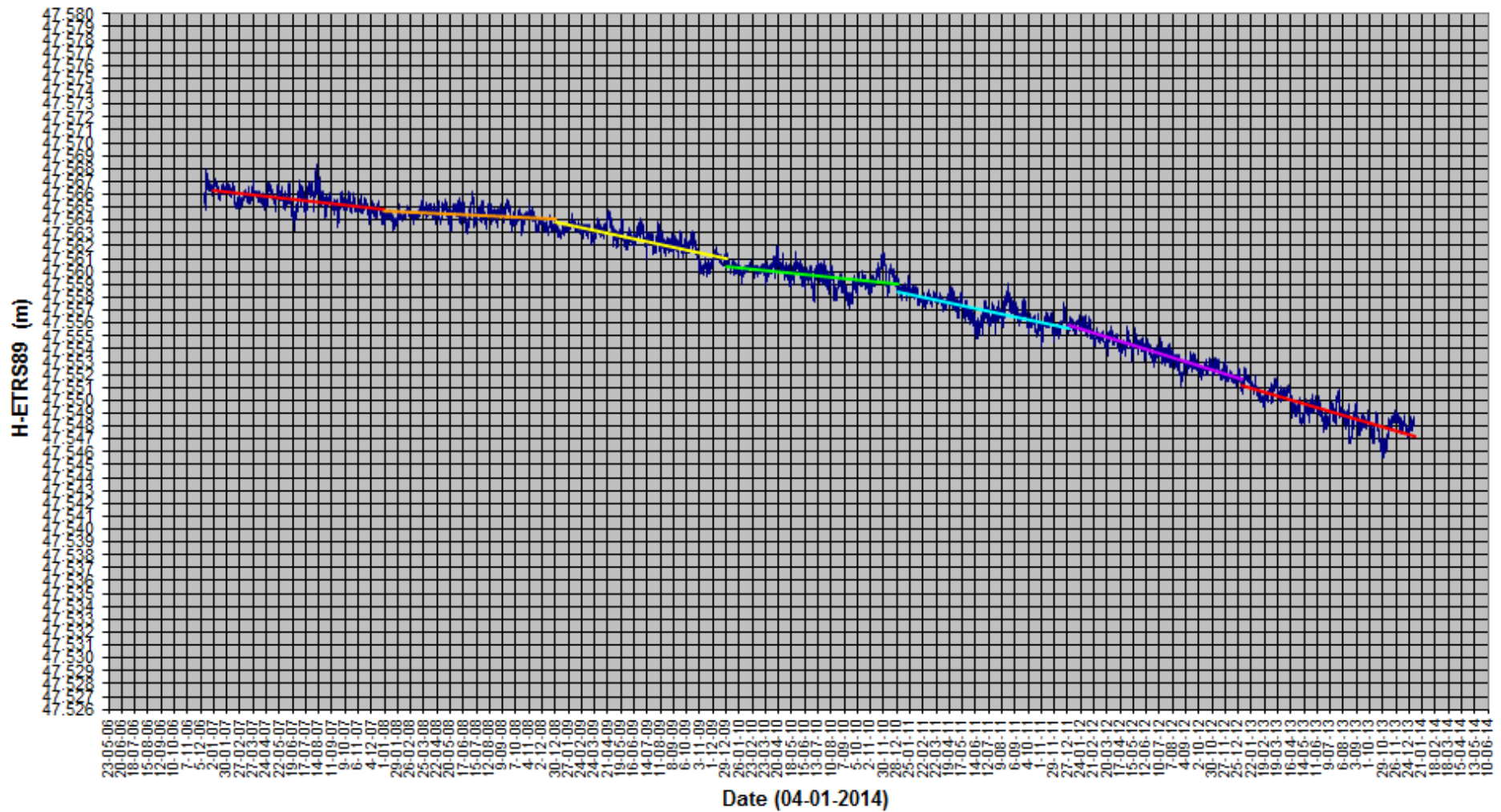
### GEO++ GNSMART H-ETRS89 AME1 + trend least squares method



## GEO++ GNSMART H-ETRS89 ANJM + trend least squares method

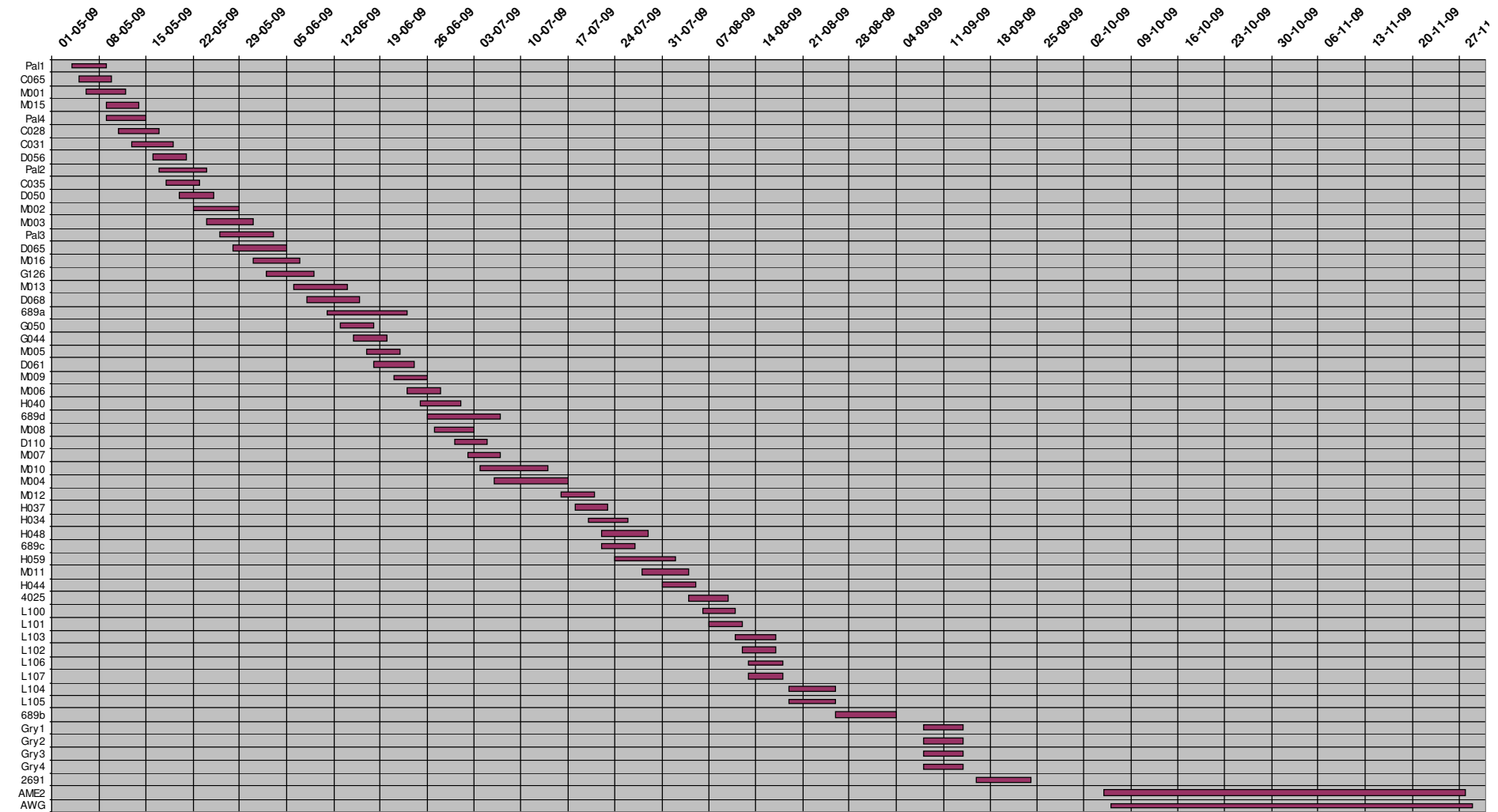


## GEO++ GNSMART H-ETRS89 MODD + trend least squares method

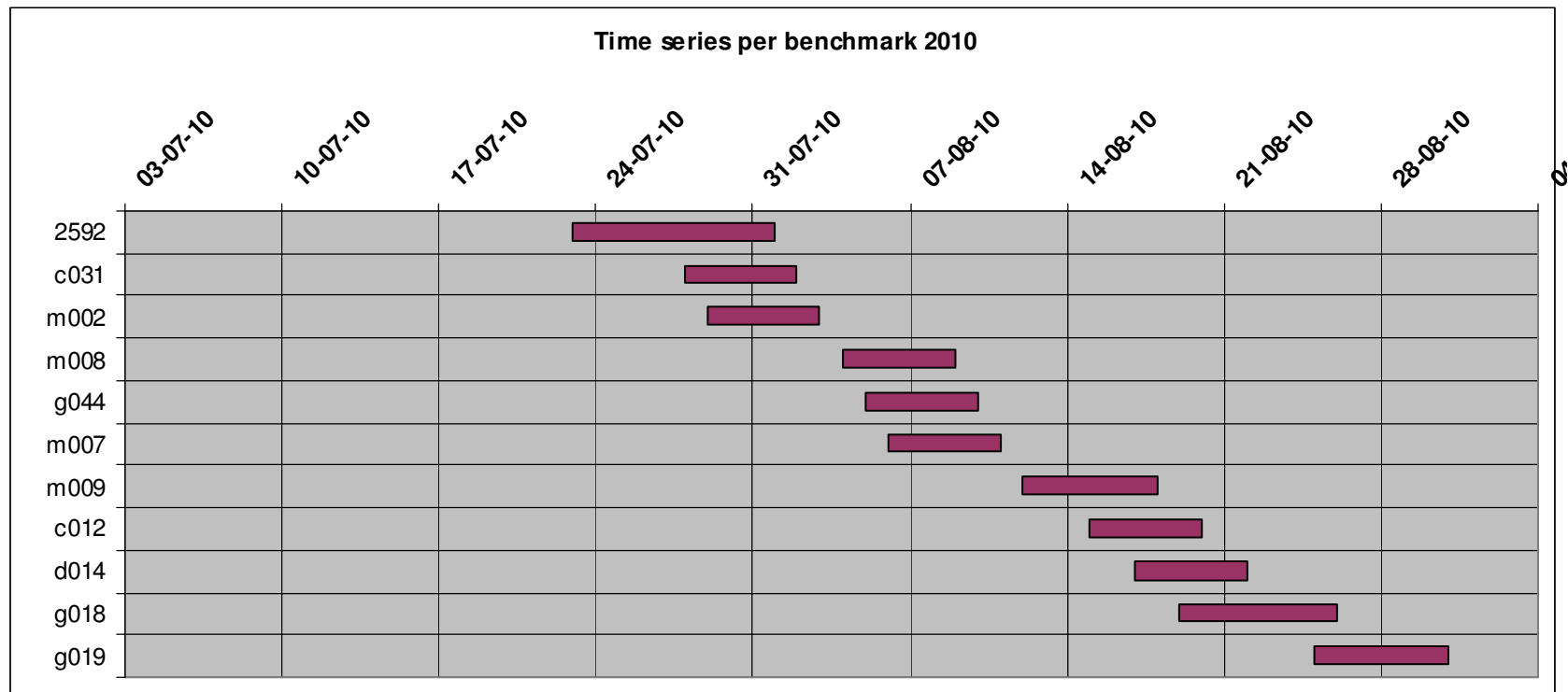




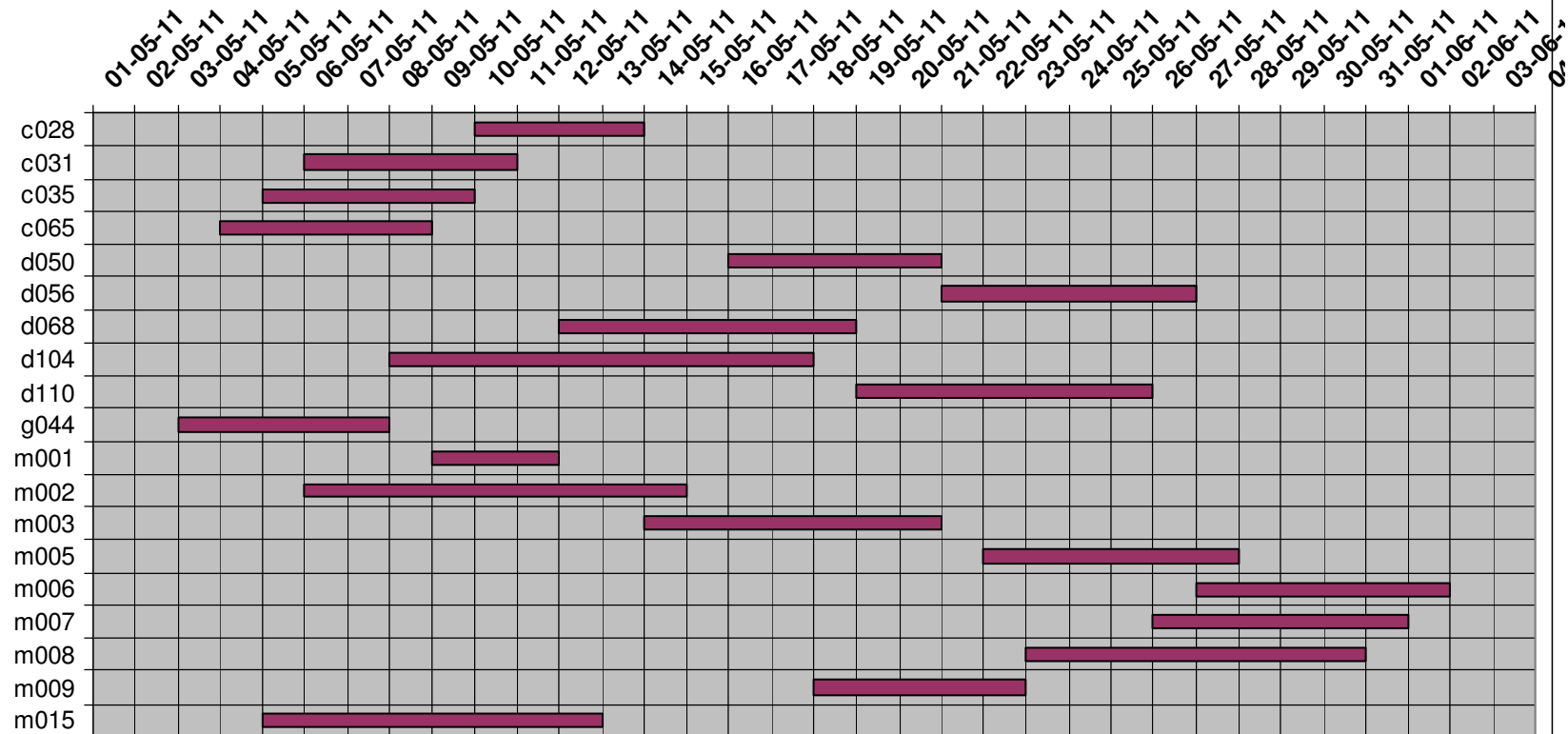
## APPENDIX IV: Time series per benchmark 2009 - 2013

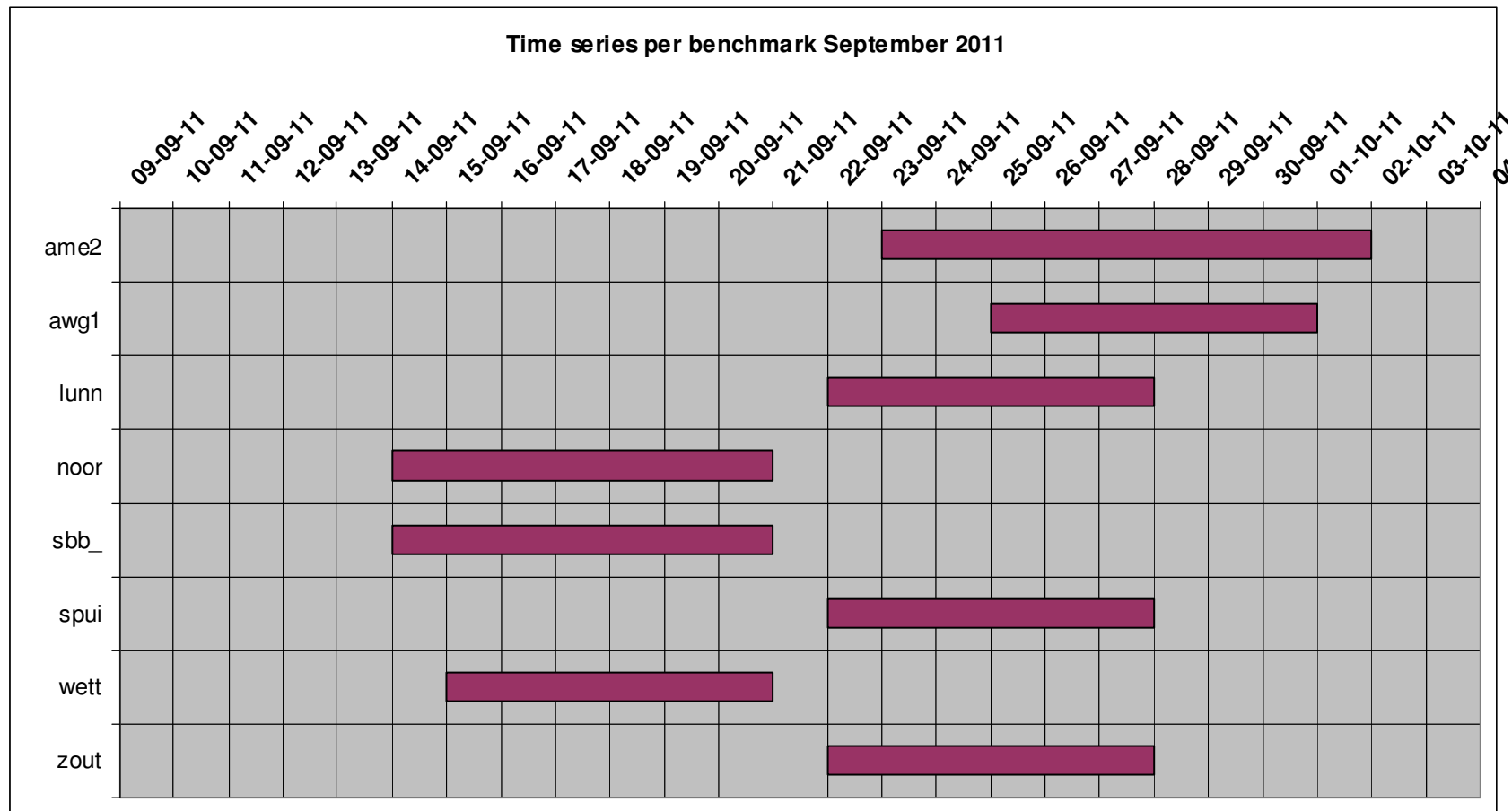






Time series per benchmark May 2011





**Time series per benchmark Waddenzee & Lauwersmeer 2012**

