

**Technical Specification**

**for**

**Dredging and Reclamation**

**H.Dh. Kulhudhuffushi Airport**

**Volume II**

Section 1 – Technical Specification

Section II – Bills of Quantities

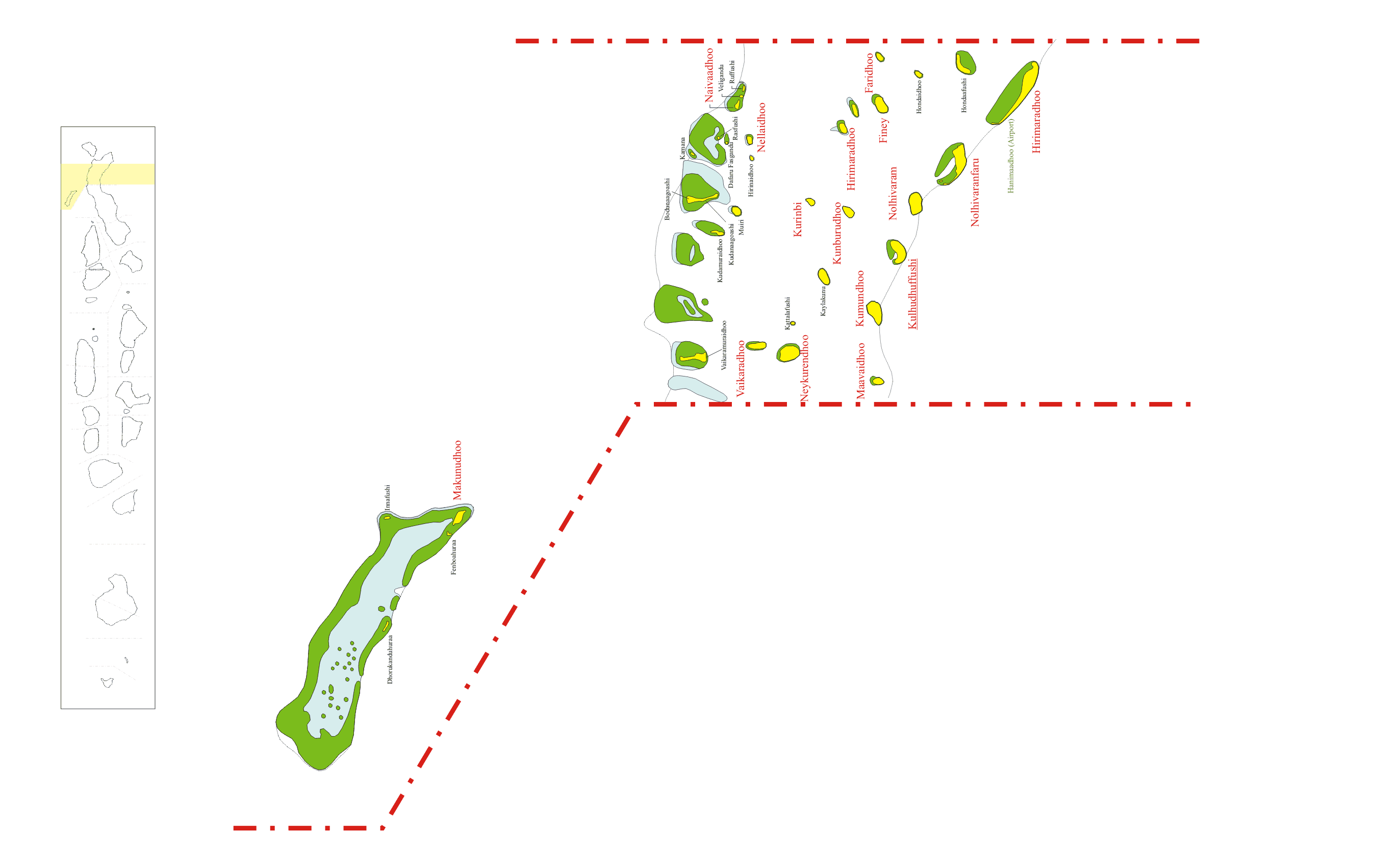
Section III– Drawings

**Prepared by:**

Regional Airports

Ministry of Tourism

March 2016

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**Section – I**

**Technical specification**

## MOBILIZATION AND DEMOBILIZATION

1.1 **Scope of Works**

1. This includes mobilization and demobilization of all constructional plant, and equipment, including testing equipment deemed necessary to complete the Works
2. The Contractor shall mobilize and deliver all constructional plant and equipment required to undertake the works and all the materials for any temporary facilities required.
3. Mobilization shall include the importation and transportation to the job-site of all equipment, constructional plant and all necessary items for the execution and completion of the works. Mobilization shall also be deemed to include any site clearance work that is necessary.
4. It is the responsibility of the Contractor to ensure that all plant and equipment brought for the project are in working condition. In the event of a break-down of constructional plant/equipment when it is beyond the ability of the personnel or when there are insufficient tools or materials at site to affect a repair in a reasonable time, the Contractor will be instructed to provide a replacement for the same at no additional cost (including mobilization) to the Owner. In such a case, no extension will be given for completion of Works. The Contractor may also be required to remove the broken plant from the Site if it is hindering the completion of any components of the Project.
5. Demobilization shall include the removal from site of all constructional plant and equipment and the removal of all temporary facilities erected by the Contractor for his convenience.
6. Mobilization costs of plant and equipment referred to herein shall be paid after the Consultant / Engineer has certified and accepted that all equipment listed for the Project and material for Temporary Works have been delivered to site or part three off, as the requirement deemed necessary.
7. Mobilization and demobilization costs have been specified for each Airport separately. The contractor may be required to provide a breakdown for the mobilization costs if in the opinion of the Consultant / Engineer, the item appears to be unbalanced or for any budgetary constrains that may have by the Owner.
8. Demobilization costs shall be paid after the Consultant / Engineer has certified and accepted that all equipment listed or as agreed has been removed form site and all temporary facilities dismantled and removed form the Site.

## 2. TEMPORARY FACILITIES

2.1 **Scope of Works**

This item consists of the following:

1. Furnishing, erection and maintenance of all site facilities such as Contractor’s camp and yard, temporary utilities and services, safety provisions, temporary roads and temporary navigations aids required for the execution of the Works as specified below;
2. Erection of all construction plant and equipment after being delivered to site; and,
3. Disassembly and removal of all site facilities, constructional plant and equipment from the site for de-mobilization.

2.2 **Provisions and Requirements**

1. The Contractor shall be responsible for temporary facilities, utilities, services and safeguards as required under the Contract.
2. Temporary and permanent utility facilities used for the construction work shall be adequate for the intended use and not be overloaded or otherwise used or arranged in any manner which will endanger persons, premises or the works themselves.
   * 1. Upon completion of the Works, unless otherwise directed or required, all site facilities, installations, utility services, constructional plant and equipment shall be disconnected, disassembled and removed form the Site.
     2. The camp area shall be kept in a clean and tidy condition throughout the construction period. The Consultant / Engineer shall have the authority to order periodical clearings at the Contractor’s cost, provided that the site for disposing of Garbage / Debris allocated by the owner and is within the stipulated distance from the work site.
     3. All accommodation, latrine and shower facilities and canteen, shall conform in every respect with regulations imposed by local health authorities.
     4. The Contractor shall provide and maintain the necessary equipment as specified in contract and accessories, for construction use for the entire construction period.
     5. The Contractor shall be responsible to arrange water, electricity etc. as required to execute the work throughout the project.
3. The Contractor shall provide and maintain a temporary electricity service and distribution lines of adequate capacity for power, lighting and other construction needs.
   * 1. All utility systems shall conform to local codes and regulations.
     2. All costs associated with the provision of utilities shall be borne by the Contractor.
     3. The Contractor shall maintain appropriate safety measures on site and around the work areas.
     4. The Contractor shall adhere to all local codes and regulations with respect to work-safety.
     5. The Contractor shall maintain appropriate notices and safety measures to warn public of dangers on site.
     6. The Contractor shall provide and maintain any temporary roads and access ways Project Site when required.

## 3. SITE EXPENSES

3.1 **Scope of Works**

This item shall cover all expenses for the staff related to the management of the site and office.

* 1. **Provisions and Requirements**

The site costs shall include but not be limited to the following:

Site office costs, including basic staff salary, overtime payments, bonuses, travel, medical fees, overseas and other allowances. Costs should also allow for stationery and office equipment.

Communication Facilities, to include the costs telephone, as well as walkie-talkie communication between the job site proper and the site office. Communication costs for the Contractor’s site office shall also be included here.

Site safety costs to include all matters related to workplace health and safety issue.

Site security costs.

First aid, to include all reasonable first aid supplies and equipment.

Insurance, costs of insuring the works and temporary facilities as required.

Waste management, to include all costs incurred in keeping the site clean.

**4. NATURAL CONDITIONS OF CLIMATE**

4.1 General climatic conditions are depending on the location of the site and surrounding atmosphere environment. It is no doubt that Maldives is governed by oceanographic circumstances rather than influence by the atmospheres of nearby continental.

4.2 **Temperature**

Daily temperature varies little throughout the year with a mean annua1 temperature of 28 CC. The mean daily minimum temperature recorded for Male’, 2009 was 26.3 °C and the daily mean maximum temperature for the same year was 31.1 °C.

The highest temperature ever recorded in the Maldives was 36.8 °C, recorded on 19 May 1991 at Kadhdhoo Meteorological Office. Likewise, the minimum temperature ever recorded in the Maldives was 17.2 °C recorded at the National Meteorological Center on 11th April 1978.

4.3 **Rainfall**

Rainfall in Maldives varies from north to south with the amount of rainfall increasing towards the south. This difference in rainfall patterns is primarily due to the NE monsoon period and April being much drier in the north than in the south.

Rainfall patterns measured throughout the country by eight rainfall stations and it is evident that there are variations in rainfall from north to south through the atoll chain, with the north being drier and the south wetter. Average monthly and annual rainfall for Male’ is 165.6 mm and 1987.7 mm respectively. There are been considerable inter-annual variation in rainfall from 1407 mm to 2711 mm over the last 35 years.

4.4 **Humidity**

The Maldives has a warm and humid tropical climate. The weather is dominated by two monsoon seasons: the north-east (dry) monsoon season from December to March and the south-west (rainy) monsoon season from May to October when winds blow predominantly from either of these two directions. The annual average relative humidity ranges from 77% to 83%.

4.5 **Wind Record**

Wind directions in the area are seasonal and governed mainly by two monsoon seasons-the NE monsoon (December to March) and SW monsoon (May to October).

Slightly stronger winds are associated with winds from the west typical of the SW monsoon season. On average wind speeds vary between 7-12 knots. The sever monsoon months are typically May, June and July during the early part of the SW monsoon, and September and October at the latter half Squally gusty winds of 50-60 knots have been recorded at Male’ (DoM, 2000).

Department of Meteorology indicates the monthly wind data at Hdh. Hanimaadhoo which is located in Haa Dhaalu Atoll and closest wind observation point. This data is shown in A-1:

**Table A-1:**

**Mean Wind Speed With frequent Direction**

H.Dh. Hanimaadhoo

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Years & Months** | **Day 1** | | **Day 2** | | **Day 3** | | **Day 4** | | **Day 5** | | **Day 6** | | **Day 7** | | **Day 8** | | **Day 9** | | **Day 10** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2010-01 | ENE | 04 | E | 04 | NNE | 03 | NNW | 03 | N | 04 | ENE | 05 | E | 05 | VRB | 02 | NNW | 03 | NNW | 03 |  |  |
| 2010-02 | ENE | 05 | E | 05 | ENE | 06 | E | 05 | E | 05 | E | 05 | E | 08 | NNW | 05 | NNE | 05 | NNW | 05 |  |  |
| 2010-03 | ENE | 05 | ENE | 06 | N | 04 | NW | 05 | WNW | 04 | W | 05 | NW | 08 | NW | 07 | NNW | 05 | ENE | 06 |  |  |
| 2010-04 | NW | 07 | NW | 06 | NW | 04 | W | 05 | W | 05 | W | 04 | WNW | 03 | ESE | 04 | NNW | 03 | NNW | 05 |  |  |
| 2010-05 | SSE | 04 | NW | 04 | NW | 04 | W | 05 | WNW | 06 | WNW | 07 | W | 06 | WNW | 07 | SSW | 06 | SW | 05 |  |  |
| 2010-06 | WSW | 05 | W | 06 | W | 06 | W | 08 | W | 09 | W | 09 | W | 08 | W | 11 | W | 14 | W | 14 |  |  |
| 2010-07 | WSW | 11 | WSW | 11 | WSW | 08 | W | 10 | WNW | 11 | WNW | 08 | WNW | 09 | NW | 09 | NNW | 11 | NW | 09 |  |  |
| 2010-08 | WNW | 07 | W | 09 | W | 10 | W | 11 | WNW | 10 | WNW | 09 | W | 09 | WNW | 09 | NW | 07 | WNW | 11 |  |  |
| 2010-09 | W | 04 | NW | 06 | WNW | 06 | W | 05 | SSW | 05 | WSW | 04 | W | 06 | WSW | 05 | WSW | 07 | WNW | 06 |  |  |
| 2010-10 | WSW | 06 | WSW | 09 | WSW | 10 | W | 08 | WSW | 09 | W | 09 | W | 08 | W | 10 | W | 07 | W | 06 |  |  |
| 2010-11 | WSW | 07 | WSW | 06 | SSW | 04 | SSW | 04 | WSW | 05 | W | 08 | W | 08 | WSW | 07 | WSW | 05 | WSW | 06 |  |  |
| 2010-12 | WSW | 03 | W | 03 | WSW | 03 | WSW | 04 | WSW | 06 | WSW | 04 | VRB | 02 | W | 03 | W | 04 | W | 05 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 11** | | **Day 12** | | **Day 13** | | **Day 14** | | **Day 15** | | **Day 16** | | **Day 17** | | **Day 18** | | **Day 19** | | **Day 20** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2010-01 | E | 05 | SE | 05 | ENE | 05 | NE | 07 | E | 09 | ENE | 05 | N | 04 | NE | 06 | NNE | 04 | NNE | 05 |  |  |
| 2010-02 | ENE | 06 | ENE | 05 | N | 05 | NE | 06 | ENE | 05 | NE | 05 | N | 06 | NW | 04 | NE | 03 | NE | 05 |  |  |
| 2010-03 | ENE | 07 | ENE | 07 | E | 06 | NNE | 04 | N | 04 | NNW | 04 | NNW | 03 | ENE | 04 | ENE | 06 | ENE | 04 |  |  |
| 2010-04 | NNW | 05 | WNW | 05 | W | 06 | NW | 07 | W | 05 | WNW | 04 | SSW | 03 | W | 03 | WNW | 04 | W | 05 |  |  |
| 2010-05 | WSW | 07 | W | 07 | W | 10 | W | 10 | WSW | 08 | WSW | 11 | WSW | 10 | WSW | 11 | W | 12 | W | 10 |  |  |
| 2010-06 | WNW | 14 | W | 11 | WSW | 12 | WSW | 07 | SSW | 05 | SSW | 07 | W | 07 | W | 05 | W | 06 | W | 07 |  |  |
| 2010-07 | NNW | 07 | NW | 05 | WSW | 05 | W | 08 | W | 11 | W | 11 | W | 11 | W | 11 | W | 10 | W | 09 |  |  |
| 2010-08 | WNW | 12 | WNW | 13 | WNW | 11 | WNW | 15 | WNW | 13 | W | 12 | W | 12 | WNW | 09 | NW | 07 | NW | 08 |  |  |
| 2010-09 | NW | 04 | NW | 06 | WNW | 07 | W | 07 | WNW | 06 | WNW | 07 | WNW | 09 | W | 12 | W | 10 | WNW | 07 |  |  |
| 2010-10 | W | 05 | WSW | 05 | WSW | 04 | W | 05 | W | 07 | W | 09 | W | 09 | W | 08 | W | 06 | W | 06 |  |  |
| 2010-11 | W | 06 | WNW | 05 | WNW | 04 | NW | 03 | W | 03 | W | 05 | W | 04 | WSW | 03 | VRB | 02 | WSW | 05 |  |  |
| 2010-12 | WNW | 05 | NW | 05 | NNW | 04 | VRB | 02 | VRB | 01 | VRB | 01 | VRB | 01 | VRB | 02 | E | 03 | E | 05 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 21** | | **Day 22** | | **Day 23** | | **Day 24** | | **Day 25** | | **Day 26** | | **Day 27** | | **Day 28** | | **Day 29** | | **Day 30** | | **Day 31** | |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |
| 2010-01 | NNE | 05 | ENE | 06 | NE | 05 | ENE | 05 | E | 07 | E | 08 | ENE | 07 | NE | 05 | NE | 05 | NE | 05 | NNE | 03 |
| 2010-02 | ENE | 06 | NNW | 04 | N | 04 | N | 04 | NE | 04 | ENE | 04 | NW | 04 | NNW | 03 |  |  |  |  |  |  |
| 2010-03 | N | 06 | NW | 06 | W | 06 | W | 05 | W | 04 | W | 04 | WNW | 03 | VRB | 02 | VRB | 02 | W | 05 | W | 06 |
| 2010-04 | W | 06 | W | 05 | W | 06 | W | 07 | W | 06 | WSW | 05 | WSW | 05 | WNW | 03 | E | 04 | SSE | 05 |  |  |
| 2010-05 | WSW | 10 | SW | 09 | SW | 09 | WSW | 11 | WSW | 10 | WSW | 09 | WSW | 09 | SW | 09 | WSW | 10 | WSW | 09 | W | 07 |
| 2010-06 | W | 08 | W | 09 | W | 08 | W | 09 | W | 12 | W | 11 | W | 09 | WNW | 13 | W | 09 | WSW | 10 |  |  |
| 2010-07 | W | 09 | W | 07 | W | 08 | W | 07 | W | 10 | W | 08 | W | 10 | W | 11 | W | 07 | WSW | 08 | W | 05 |
| 2010-08 | WNW | 08 | NW | 09 | NW | 10 | WNW | 11 | W | 10 | W | 09 | W | 11 | WNW | 10 | W | 10 | WNW | 06 | W | 04 |
| 2010-09 | W | 08 | W | 07 | WSW | 08 | WSW | 07 | W | 07 | WNW | 05 | W | 05 | WSW | 08 | WSW | 06 | W | 06 |  |  |
| 2010-10 | W | 07 | W | 07 | W | 06 | W | 05 | WNW | 04 | WNW | 04 | WNW | 05 | WNW | 05 | NW | 05 | W | 06 | WNW | 07 |
| 2010-11 | W | 04 | WNW | 03 | WNW | 03 | NNW | 03 | VRB | 02 | WSW | 05 | WNW | 06 | WNW | 03 | WSW | 03 | SE | 05 |  |  |
| 2010-12 | E | 03 | VRB | 02 | VRB | 02 | VRB | 01 | VRB | 02 | VRB | 02 | NE | 03 | NE | 03 | NE | 04 | VRB | 02 | NW | 03 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 1** | | **Day 2** | | **Day 3** | | **Day 4** | | **Day 5** | | **Day 6** | | **Day 7** | | **Day 8** | | **Day 9** | | **Day 10** | |  |  |
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| 2011-01 | NNW | 05 | N | 04 | N | 03 | NNW | 03 | NNW | 03 | WNW | 04 | WNW | 03 | NNW | 03 | NNW | 03 | NNW | 03 |  |  |
| 2011-02 | VRB | 02 | VRB | 01 | VRB | 01 | NNW | 03 | VRB | 01 | CALM | 00 | VRB | 01 | VRB | 02 | VRB | 01 | VRB | 01 |  |  |
| 2011-03 | NNE | 05 | N | 05 | N | 04 | NNW | 05 | N | 05 | ENE | 06 | ENE | 04 | N | 03 | NNE | 04 | NNW | 04 |  |  |
| 2011-04 | W | 05 | WSW | 05 | WSW | 06 | NW | 05 | NW | 05 | NNW | 04 | NNW | 03 | NNW | 04 | NW | 05 | N | 05 |  |  |
| 2011-05 | WSW | 08 | WSW | 08 | W | 10 | WNW | 08 | WNW | 07 | WNW | 08 | WNW | 10 | W | 08 | NW | 04 | W | 03 |  |  |
| 2011-06 | W | 16 | SW | 11 | SW | 09 | WSW | 10 | W | 09 | W | 08 | W | 08 | W | 09 | WSW | 08 | SW | 07 |  |  |
| 2011-07 | W | 10 | W | 08 | WSW | 06 | WSW | 07 | W | 14 | W | 13 | W | 13 | NW | 08 | WNW | 08 | W | 09 |  |  |
| 2011-08 | W | 06 | SW | 06 | SSW | 07 | S | 07 | W | 09 | W | 09 | W | 10 | W | 11 | W | 11 | W | 07 |  |  |
| 2011-09 | SW | 09 | W | 09 | W | 07 | W | 06 | W | 04 | WSW | 05 | W | 07 | W | 07 | WSW | 07 | W | 09 |  |  |
| 2011-10 | WNW | 08 | WNW | 08 | WNW | 07 | NW | 06 | NW | 03 | NW | 04 | W | 05 | W | 05 | W | 06 | W | 06 |  |  |
| 2011-11 | NNW | 04 | W | 05 | WSW | 08 | SSW | 08 | S | 09 | SSE | 05 | NW | 04 | NNW | 05 | SSE | 05 | ESE | 06 |  |  |
| 2011-12 | VRB | 02 | E | 03 | SE | 03 | SSE | 03 | E | 04 | VRB | 02 | N | 04 | ENE | 06 | E | 09 | E | 07 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2011-01 | VRB | 02 | VRB | 02 | VRB | 02 | N | 03 | N | 03 | VRB | 02 | VRB | 02 | NE | 03 | E | 04 | NE | 04 |  |  |
| 2011-02 | VRB | 01 | ENE | 04 | VRB | 02 | VRB | 01 | CALM | 00 | NNE | 03 | NNW | 03 | N | 03 | N | 03 | NNW | 04 |  |  |
| 2011-03 | WNW | 06 | W | 04 | WNW | 06 | NW | 06 | NW | 04 | WNW | 03 | W | 03 | SE | 03 | E | 04 | E | 04 |  |  |
| 2011-04 | N | 03 | VRB | 02 | VRB | 02 | NW | 05 | WNW | 05 | VRB | 02 | W | 03 | NNW | 04 | W | 06 | NNE | 03 |  |  |
| 2011-05 | VRB | 02 | W | 04 | WNW | 04 | W | 05 | WSW | 04 | SSE | 03 | WSW | 04 | W | 04 | W | 05 | W | 04 |  |  |
| 2011-06 | SSW | 05 | SSW | 06 | WSW | 08 | WSW | 09 | WSW | 08 | WSW | 09 | WSW | 11 | W | 11 | WNW | 11 | W | 11 |  |  |
| 2011-07 | WNW | 13 | W | 11 | W | 12 | SW | 08 | SW | 08 | SSW | 08 | W | 10 | W | 07 | WNW | 09 | W | 07 |  |  |
| 2011-08 | NW | 06 | W | 09 | WNW | 07 | W | 06 | W | 05 | WNW | 07 | W | 08 | WNW | 09 | W | 10 | WNW | 13 |  |  |
| 2011-09 | W | 12 | W | 12 | W | 12 | W | 12 | W | 11 | W | 07 | W | 04 | W | 04 | W | 04 | WNW | 05 |  |  |
| 2011-10 | W | 06 | WNW | 06 | W | 05 | W | 04 | W | 04 | W | 03 | VRB | 02 | S | 04 | SSE | 04 | WSW | 03 |  |  |
| 2011-11 | ENE | 05 | SE | 04 | E | 04 | NE | 05 | ENE | 05 | ENE | 04 | NNE | 04 | E | 03 | E | 08 | ENE | 06 |  |  |
| 2011-12 | E | 07 | E | 07 | VRB | 02 | VRB | 02 | NE | 03 | VRB | 02 | ENE | 05 | ENE | 03 | N | 05 | N | 05 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 21** | | **Day 22** | | **Day 23** | | **Day 24** | | **Day 25** | | **Day 26** | | **Day 27** | | **Day 28** | | **Day 29** | | **Day 30** | | **Day 31** | |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |
| 2011-01 | VRB | 02 | NE | 03 | ENE | 03 | NE | 03 | VRB | 02 | NE | 03 | VRB | 02 | VRB | 02 | VRB | 02 | VRB | 02 | VRB | 02 |
| 2011-02 | NNW | 04 | N | 04 | N | 04 | NNW | 03 | N | 04 | N | 05 | N | 06 | N | 04 |  |  |  |  |  |  |
| 2011-03 | NNE | 03 | NW | 04 | W | 06 | WNW | 07 | NW | 07 | NW | 05 | WNW | 06 | NW | 06 | WNW | 05 | W | 04 | W | 03 |
| 2011-04 | W | 03 | W | 05 | WSW | 08 | W | 06 | WNW | 08 | WNW | 09 | WNW | 09 | W | 11 | WNW | 09 | W | 08 |  |  |
| 2011-05 | WSW | 07 | W | 07 | W | 11 | W | 09 | W | 08 | W | 09 | W | 11 | WSW | 10 | W | 08 | W | 09 | WSW | 11 |
| 2011-06 | WNW | 09 | WNW | 11 | WNW | 11 | W | 12 | W | 13 | W | 12 | W | 12 | WNW | 10 | WNW | 08 | W | 10 |  |  |
| 2011-07 | W | 07 | WSW | 05 | W | 07 | W | 10 | W | 09 | WSW | 08 | SW | 05 | W | 06 | W | 05 | WSW | 05 | W | 06 |
| 2011-08 | WNW | 10 | WNW | 08 | WNW | 07 | W | 07 | WNW | 04 | W | 05 | W | 06 | SW | 06 | WSW | 06 | SW | 06 | WSW | 10 |
| 2011-09 | WNW | 07 | NW | 06 | W | 05 | WNW | 06 | W | 06 | NW | 06 | NW | 06 | WNW | 07 | NW | 07 | NW | 06 |  |  |
| 2011-10 | NNW | 04 | S | 05 | WSW | 03 | E | 03 | ESE | 06 | WSW | 09 | SW | 05 | SSE | 04 | S | 04 | W | 06 | NNW | 07 |
| 2011-11 | E | 09 | E | 05 | N | 03 | N | 07 | N | 06 | W | 12 | W | 08 | WSW | 05 | VRB | 02 | VRB | 01 |  |  |
| 2011-12 | NNW | 05 | SE | 05 | SE | 04 | NNE | 03 | NNW | 03 | N | 04 | N | 04 | NNW | 05 | NW | 06 | WNW | 08 | W | 07 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 1** | | **Day 2** | | **Day 3** | | **Day 4** | | **Day 5** | | **Day 6** | | **Day 7** | | **Day 8** | | **Day 9** | | **Day 10** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2012-01 | S | 07 | SSE | 06 | E | 06 | NE | 06 | N | 04 | E | 06 | ENE | 08 | NNE | 06 | ENE | 05 | E | 04 |  |  |
| 2012-02 | N | 03 | ENE | 06 | NNE | 05 | N | 04 | ENE | 04 | N | 05 | N | 05 | N | 05 | NNE | 05 | E | 05 |  |  |
| 2012-03 | N | 03 | N | 03 | NNW | 05 | NNW | 04 | W | 03 | NNW | 05 | WNW | 06 | N | 07 | NW | 08 | NW | 07 |  |  |
| 2012-04 | NW | 03 | VRB | 02 | VRB | 02 | NNE | 03 | NNW | 03 | WNW | 05 | NW | 05 | NNW | 04 | VRB | 02 | VRB | 02 |  |  |
| 2012-05 | NW | 04 | WNW | 04 | W | 03 | WSW | 06 | W | 07 | W | 06 | NW | 05 | NW | 04 | NW | 04 | WNW | 05 |  |  |
| 2012-06 | W | 10 | WNW | 09 | WNW | 11 | W | 11 | W | 11 | W | 12 | W | 10 | W | 11 | W | 10 | W | 10 |  |  |
| 2012-07 | WSW | 11 | W | 11 | W | 11 | W | 09 | W | 10 | WNW | 11 | W | 10 | W | 13 | WNW | 13 | WNW | 11 |  |  |
| 2012-08 | VRB | 02 | WSW | 03 | WSW | 05 | WSW | 07 | WSW | 06 | WSW | 04 | S | 05 | S | 05 | WSW | 05 | WSW | 07 |  |  |
| 2012-09 | W | 05 | W | 07 | W | 11 | W | 07 | S | 04 | W | 04 | W | 04 | W | 10 | WNW | 11 | W | 06 |  |  |
| 2012-10 | W | 08 | W | 06 | W | 05 | WSW | 04 | WNW | 03 | VRB | 02 | NW | 04 | NNW | 04 | NW | 05 | NW | 06 |  |  |
| 2012-11 | W | 07 | W | 05 | NW | 03 | N | 03 | WNW | 04 | VRB | 02 | VRB | 01 | VRB | 01 | VRB | 02 | VRB | 02 |  |  |
| 2012-12 | VRB | 01 | VRB | 01 | VRB | 01 | N | 03 | E | 04 | E | 09 | E | 07 | E | 05 | E | 07 | E | 07 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 11** | | **Day 12** | | **Day 13** | | **Day 14** | | **Day 15** | | **Day 16** | | **Day 17** | | **Day 18** | | **Day 19** | | **Day 20** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2012-01 | N | 06 | NNE | 05 | NNE | 05 | N | 05 | N | 04 | E | 05 | ENE | 06 | NE | 04 | NNE | 04 | NW | 04 |  |  |
| 2012-02 | E | 04 | ENE | 05 | NE | 04 | NNE | 04 | N | 05 | N | 04 | NNE | 04 | NE | 05 | NNE | 05 | N | 04 |  |  |
| 2012-03 | WNW | 04 | N | 04 | N | 04 | WNW | 04 | E | 05 | SE | 03 | NE | 03 | NW | 03 | NW | 04 | NW | 03 |  |  |
| 2012-04 | WSW | 03 | NW | 04 | N | 03 | NNW | 03 | W | 03 | WSW | 04 | W | 05 | W | 07 | W | 06 | W | 05 |  |  |
| 2012-05 | WNW | 07 | W | 07 | WNW | 06 | WNW | 06 | W | 05 | WSW | 04 | WNW | 04 | WNW | 07 | W | 10 | WNW | 08 |  |  |
| 2012-06 | W | 10 | W | 10 | WSW | 12 | W | 10 | W | 09 | W | 10 | WSW | 10 | WSW | 09 | WSW | 07 | WSW | 07 |  |  |
| 2012-07 | WNW | 10 | WNW | 11 | WNW | 12 | WNW | 10 | NW | 10 | NW | 07 | WNW | 08 | WNW | 08 | WNW | 07 | W | 10 |  |  |
| 2012-08 | W | 09 | W | 07 | WNW | 06 | W | 08 | WNW | 08 | WNW | 11 | WNW | 10 | WNW | 11 | WNW | 08 | W | 07 |  |  |
| 2012-09 | W | 07 | W | 05 | W | 06 | W | 08 | W | 09 | WNW | 08 | WNW | 08 | WNW | 09 | N | 04 | NNW | 05 |  |  |
| 2012-10 | NW | 07 | NW | 06 | N | 04 | S | 04 | SSE | 06 | SSE | 04 | VRB | 02 | W | 03 | W | 04 | WNW | 04 |  |  |
| 2012-11 | W | 03 | S | 04 | NW | 03 | VRB | 01 | VRB | 01 | VRB | 02 | VRB | 01 | VRB | 01 | CALM | 00 | VRB | 01 |  |  |
| 2012-12 | ENE | 09 | ENE | 06 | NE | 06 | E | 06 | ENE | 06 | NE | 05 | NE | 07 | NE | 06 | ENE | 06 | E | 13 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 21** | | **Day 22** | | **Day 23** | | **Day 24** | | **Day 25** | | **Day 26** | | **Day 27** | | **Day 28** | | **Day 29** | | **Day 30** | | **Day 31** | |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |
| 2012-01 | N | 03 | ESE | 03 | ENE | 04 | E | 05 | NE | 04 | NE | 05 | E | 04 | NNE | 05 | N | 05 | N | 05 | NNW | 05 |
| 2012-02 | N | 05 | NNW | 04 | NNW | 04 | E | 07 | E | 04 | N | 05 | E | 05 | N | 04 | N | 04 |  |  |  |  |
| 2012-03 | WSW | 04 | W | 06 | NW | 06 | NNW | 04 | N | 03 | N | 03 | NW | 04 | E | 03 | NW | 03 | NW | 06 | NW | 06 |
| 2012-04 | WNW | 08 | WNW | 08 | WNW | 09 | WNW | 10 | WNW | 10 | W | 09 | WSW | 10 | W | 10 | WNW | 09 | WNW | 07 |  |  |
| 2012-05 | WNW | 10 | WNW | 08 | WNW | 06 | W | 06 | W | 06 | W | 06 | W | 08 | NW | 08 | WNW | 08 | WNW | 10 | W | 13 |
| 2012-06 | WSW | 06 | W | 07 | W | 07 | W | 06 | WNW | 05 | W | 04 | W | 07 | WNW | 08 | WNW | 10 | W | 09 |  |  |
| 2012-07 | W | 11 | W | 12 | W | 10 | W | 11 | W | 10 | WNW | 09 | WNW | 09 | WNW | 08 | WNW | 06 | W | 05 | W | 04 |
| 2012-08 | WNW | 08 | NW | 08 | WNW | 09 | NW | 08 | WNW | 10 | WNW | 08 | W | 07 | WSW | 06 | SW | 08 | SW | 07 | SSW | 06 |
| 2012-09 | NNE | 03 | NNW | 04 | NW | 04 | NW | 04 | NNW | 04 | NW | 04 | WNW | 07 | NW | 08 | NW | 08 | W | 09 |  |  |
| 2012-10 | S | 05 | S | 06 | SE | 03 | ENE | 03 | ENE | 06 | E | 05 | E | 05 | ENE | 08 | E | 09 | N | 08 | W | 06 |
| 2012-11 | VRB | 01 | VRB | 01 | N | 04 | NW | 04 | E | 04 | ENE | 04 | VRB | 01 | N | 05 | NNW | 03 | S | 04 |  |  |
| 2012-12 | E | 08 | E | 04 | E | 04 | N | 04 | N | 04 | VRB | 02 | NW | 04 | N | 05 | N | 05 | N | 03 | E | 04 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 1** | | **Day 2** | | **Day 3** | | **Day 4** | | **Day 5** | | **Day 6** | | **Day 7** | | **Day 8** | | **Day 9** | | **Day 10** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2013-01 | E | 06 | VRB | 1 | VRB | 1 | N | 5 | NNW | 7 | N | 6 | N | 8 | NW | 7 | NNW | 6 | N | 3 |  |  |
| 2013-02 | ENE | 06 | E | 04 | VRB | 02 | VRB | 02 | E | 03 | NNE | 03 | NNE | 03 | N | 03 | NNE | 05 | ENE | 05 |  |  |
| 2013-03 | NNW | 05 | NW | 03 | N | 03 | N | 04 | N | 03 | E | 07 | E | 07 | E | 07 | ENE | 06 | ENE | 05 |  |  |
| 2013-04 | NW | 06 | NNW | 06 | N | 06 | NNW | 06 | NW | 05 | NW | 06 | NW | 06 | NNW | 04 | VRB | 02 | NW | 03 |  |  |
| 2013-05 | NW | 05 | WSW | 07 | W | 07 | WNW | 10 | WNW | 09 | W | 07 | WNW | 05 | WNW | 06 | W | 08 | WNW | 08 |  |  |
| 2013-06 | W | 10 | W | 10 | W | 10 | W | 09 | W | 09 | WNW | 12 | W | 18 | WSW | 11 | W | 10 | W | 10 |  |  |
| 2013-07 | W | 08 | W | 10 | W | 10 | W | 09 | WNW | 10 | NW | 09 | W | 12 | W | 11 | W | 11 | NW | 11 |  |  |
| 2013-08 | WSW | 10 | W | 10 | W | 11 | W | 11 | WNW | 09 | WNW | 11 | WNW | 09 | WNW | 09 | WNW | 08 | WNW | 07 |  |  |
| 2013-09 | NW | 08 | WNW | 04 | WSW | 04 | W | 06 | W | 06 | WNW | 07 | NW | 07 | WNW | 11 | WNW | 10 | WNW | 09 |  |  |
| 2013-10 | WNW | 10 | WNW | 08 | W | 06 | W | 06 | W | 06 | WNW | 08 | W | 07 | W | 06 | W | 06 | W | 07 |  |  |
| 2013-11 | ENE | 03 | VRB | 02 | ENE | 03 | ENE | 06 | E | 10 | ESE | 06 | E | 05 | NNW | 05 | NE | 04 | ESE | 03 |  |  |
| 2013-12 | ENE | 03 | NNW | 04 | ENE | 03 | VRB | 02 | N | 03 | NW | 04 | N | 05 | WNW | 05 | NNW | 04 | NNW | 05 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 11** |  | **Day 12** | | **Day 13** | | **Day 14** | | **Day 15** | | **Day 16** | | **Day 17** | | **Day 18** | | **Day 19** | | **Day 20** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2013-01 | VRB | 2 | VRB | 2 | N | 3 | E | 4 | ENE | 5 | ENE | 10 | NNE | 8 | NNE | 6 | NE | 5 | ENE | 5 |  |  |
| 2013-02 | ENE | 05 | NE | 05 | N | 05 | E | 08 | SE | 05 | SE | 05 | SSE | 05 | E | 04 | ENE | 05 | E | 05 |  |  |
| 2013-03 | E | 03 | ENE | 03 | W | 03 | N | 04 | NNE | 04 | NE | 04 | ESE | 05 | VRB | 02 | VRB | 02 | NNW | 03 |  |  |
| 2013-04 | NNW | 03 | NW | 04 | NW | 04 | W | 04 | WSW | 06 | NW | 06 | NW | 06 | NW | 05 | NW | 06 | NW | 06 |  |  |
| 2013-05 | W | 09 | W | 09 | W | 08 | WNW | 08 | WSW | 09 | W | 04 | WSW | 09 | WSW | 10 | W | 10 | W | 07 |  |  |
| 2013-06 | WSW | 12 | WSW | 14 | W | 12 | W | 13 | WSW | 13 | WSW | 12 | WSW | 11 | WSW | 10 | W | 10 | W | 09 |  |  |
| 2013-07 | WNW | 09 | W | 09 | WNW | 09 | WNW | 10 | WNW | 09 | W | 06 | WSW | 05 | WSW | 07 | WSW | 07 | SSW | 06 |  |  |
| 2013-08 | WNW | 08 | WNW | 08 | W | 10 | WNW | 09 | WNW | 07 | W | 06 | W | 06 | W | 05 | W | 04 | W | 06 |  |  |
| 2013-09 | W | 08 | W | 08 | W | 11 | W | 10 | W | 11 | W | 14 | W | 13 | W | 11 | W | 13 | W | 10 |  |  |
| 2013-10 | W | 10 | WNW | 09 | W | 07 | WNW | 07 | WNW | 08 | WNW | 11 | WNW | 08 | W | 08 | WSW | 09 | WNW | 10 |  |  |
| 2013-11 | SSW | 06 | SW | 09 | SSW | 04 | W | 05 | E | 03 | E | 03 | VRB | 02 | SSE | 03 | VRB | 02 | W | 03 |  |  |
| 2013-12 | NNW | 06 | NW | 08 | WNW | 07 | SSE | 03 | E | 03 | NNE | 03 | NNE | 05 | ENE | 05 | NNE | 04 | NE | 06 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 21** | | **Day 22** | | **Day 23** | | **Day 24** | | **Day 25** | | **Day 26** | | **Day 27** | | **Day 28** | | **Day 29** | | **Day 30** | | **Day 31** | |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |
| 2013-01 | NNE | 5 | VRB | 2 | ENE | 3 | ENE | 03 | N | 05 | NNE | 06 | E | 07 | E | 09 | ENE | 04 | E | 06 | E | 09 |
| 2013-02 | N | 05 | N | 05 | NNE | 04 | E | 04 | ENE | 05 | NNW | 03 | N | 06 | N | 05 |  |  |  |  |  |  |
| 2013-03 | N | 04 | NNW | 03 | NNW | 04 | N | 04 | NNW | 05 | NW | 05 | NNW | 06 | NNW | 05 | NNW | 07 | NW | 06 | NNW | 05 |
| 2013-04 | WNW | 04 | VRB | 02 | ENE | 03 | N | 03 | W | 04 | NW | 03 | NW | 03 | W | 04 | NW | 07 | NW | 06 |  |  |
| 2013-05 | W | 08 | W | 06 | WSW | 07 | WSW | 08 | W | 08 | WSW | 07 | W | 06 | W | 08 | W | 09 | WSW | 10 | W | 11 |
| 2013-06 | W | 11 | W | 13 | W | 10 | WSW | 11 | SW | 08 | SSW | 06 | SSW | 05 | S | 04 | W | 06 | W | 05 |  |  |
| 2013-07 | W | 06 | W | 09 | SW | 08 | WSW | 08 | SW | 07 | SSW | 05 | S | 08 | WNW | 10 | W | 06 | WSW | 07 | WSW | 09 |
| 2013-08 | WNW | 07 | WNW | 06 | WNW | 08 | NW | 10 | WNW | 10 | NW | 09 | NW | 13 | WNW | 12 | NW | 12 | NW | 12 | NW | 08 |
| 2013-09 | W | 08 | W | 07 | WNW | 06 | WNW | 07 | WNW | 05 | WNW | 03 | W | 03 | W | 05 | W | 07 | W | 10 |  |  |
| 2013-10 | W | 10 | W | 09 | W | 07 | WNW | 08 | W | 07 | WNW | 05 | WNW | 03 | NW | 04 | W | 04 | N | 04 | VRB | 02 |
| 2013-11 | VRB | 02 | VRB | 01 | SSW | 04 | WSW | 03 | W | 04 | WNW | 05 | N | 03 | N | 03 | SE | 05 | E | 06 |  |  |
| 2013-12 | NE | 06 | ENE | 05 | E | 08 | E | 08 | NNE | 05 | NNE | 03 | E | 03 | E | 05 | E | 04 | E | 05 | ENE | 06 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 1** | | **Day 2** | | **Day 3** | | **Day 4** | | **Day 5** | | **Day 6** | | **Day 7** | | **Day 8** | | **Day 9** | | **Day 10** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2014-01 | ENE | 05 | NNE | 04 | E | 03 | VRB | 01 | VRB | 02 | NE | 03 | NNE | 04 | NNE | 05 | E | 07 | E | 06 |  |  |
| 2014-02 | NW | 03 | ENE | 04 | ENE | 05 | ENE | 03 | N | 04 | NE | 07 | NNE | 05 | NE | 05 | NE | 04 | NNE | 04 |  |  |
| 2014-03 | NNE | 04 | N | 05 | N | 04 | E | 05 | E | 05 | ENE | 06 | NE | 08 | E | 06 | N | 04 | E | 05 |  |  |
| 2014-04 | WNW | 07 | NW | 06 | WNW | 05 | NW | 03 | NNW | 03 | S | 04 | E | 04 | SSE | 05 | SSW | 05 | W | 05 |  |  |
| 2014-05 | WNW | 4 | WNW | 4 | W | 5 | W | 6 | NW | 7 | WNW | 6 | NW | 3 | WSW | 9 | W | 7 | W | 6 |  |  |
| 2014-06 | WSW | 9 | WSW | 10 | WSW | 10 | WSW | 11 | W | 10 | W | 10 | W | 13 | WSW | 13 | WSW | 12 | WSW | 13 |  |  |
| 2014-07 | WNW | 10 | WNW | 12 | WNW | 14 | WNW | 13 | W | 13 | W | 11 | W | 11 | W | 9 | W | 11 | WSW | 11 |  |  |
| 2014-08 | WSW | 10 | W | 11 | WSW | 12 | W | 9 | W | 10 | W | 8 | W | 7 | W | 5 | W | 7 | W | 10 |  |  |
| 2014-09 | WSW | 9 | WSW | 8 | W | 5 | W | 5 | W | 5 | W | 8 | W | 8 | W | 7 | WNW | 7 | WNW | 7 |  |  |
| 2014-10 | WSW | 4 | W | 4 | W | 6 | NW | 4 | W | 3 | WSW | 4 | W | 8 | W | 8 | W | 7 | WNW | 5 |  |  |
| 2014-11 | W | 7 | W | 6 | W | 7 | W | 6 | W | 7 | NNW | 6 | NW | 4 | WNW | 4 | WNW | 6 | WNW | 5 |  |  |
| 2014-12 | VRB | 2 | SSE | 3 | VRB | 1 | NNW | 3 | N | 3 | E | 6 | E | 5 | VRB | 2 | NW | 3 | E | 4 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 11** | | **Day 12** | | **Day 13** | | **Day 14** | | **Day 15** | | **Day 16** | | **Day 17** | | **Day 18** | | **Day 19** | | **Day 20** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2014-01 | E | 06 | E | 05 | NNE | 06 | ENE | 05 | E | 08 | E | 06 | E | 04 | WNW | 03 | E | 06 | E | 06 |  |  |
| 2014-02 | NNW | 03 | VRB | 02 | E | 04 | E | 05 | ESE | 03 | E | 04 | NNE | 06 | N | 05 | N | 05 | NNW | 03 |  |  |
| 2014-03 | ENE | 08 | E | 10 | NNE | 06 | ENE | 05 | E | 04 | NNE | 06 | NNE | 04 | N | 04 | E | 06 | E | 03 |  |  |
| 2014-04 | W | 06 | NW | 05 | NW | 04 | WNW | 03 | NW | 04 | WNW | 03 | W | 04 | NW | 06 | NW | 08 | W | 06 |  |  |
| 2014-05 | W | 5 | WNW | 4 | NW | 4 | NW | 4 | NW | 5 | WNW | 5 | WNW | 6 | NW | 6 | VRB | 2 | SSW | 3 |  |  |
| 2014-06 | WSW | 11 | WSW | 10 | W | 9 | WNW | 9 | WNW | 9 | W | 9 | W | 9 | WSW | 10 | WSW | 11 | W | 11 |  |  |
| 2014-07 | W | 10 | W | 12 | W | 12 | W | 11 | W | 10 | W | 8 | WSW | 7 | WSW | 10 | WSW | 9 | WSW | 8 |  |  |
| 2014-08 | W | 9 | W | 7 | W | 6 | NW | 6 | WNW | 6 | WNW | 5 | NW | 6 | NW | 13 | NNW | 11 | WNW | 12 |  |  |
| 2014-09 | NW | 6 | NW | 6 | WNW | 8 | WNW | 8 | W | 7 | WNW | 7 | WNW | 8 | NW | 8 | NW | 8 | NW | 8 |  |  |
| 2014-10 | W | 6 | WNW | 9 | W | 7 | W | 3 | N | 4 | N | 4 | W | 4 | SSW | 4 | VRB | 2 | S | 5 |  |  |
| 2014-11 | WNW | 4 | NW | 5 | W | 3 | SE | 3 | E | 6 | E | 7 | E | 5 | SSE | 3 | E | 9 | NE | 5 |  |  |
| 2014-12 | E | 5 | E | 6 | E | 5 | SE | 6 | SSE | 4 | VRB | 2 | N | 5 | E | 5 | E | 10 | E | 9 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 21** | | **Day 22** | | **Day 23** | | **Day 24** | | **Day 25** | | **Day 26** | | **Day 27** | | **Day 28** | | **Day 29** | | **Day 30** | | **Day 31** | |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |
| 2014-01 | E | 06 | E | 07 | E | 08 | E | 04 | E | 05 | E | 07 | ENE | 06 | E | 03 | E | 03 | NNE | 04 | ENE | 03 |
| 2014-02 | N | 04 | NNE | 05 | N | 05 | ENE | 09 | E | 08 | E | 07 | ENE | 04 | e | 03 |  |  |  |  |  |  |
| 2014-03 | NW | 03 | NNW | 04 | NNW | 03 | NNW | 03 | NE | 08 | E | 04 | N | 04 | NE | 06 | NNE | 04 | W | 03 | NW | 05 |
| 2014-04 | W | 04 | N | 03 | W | 04 | W | 04 | WNW | 05 | W | 05 | WNW | 05 | WNW | 05 | WNW | 04 | W | 05 |  |  |
| 2014-05 | W | 4 | WSW | 5 | WSW | 6 | WSW | 9 | W | 7 | W | 6 | SSW | 3 | SW | 4 | SSW | 4 | WSW | 7 | WSW | 8 |
| 2014-06 | W | 11 | W | 11 | WNW | 12 | WNW | 12 | WNW | 11 | WNW | 9 | WNW | 9 | WNW | 9 | W | 11 | WNW | 12 |  |  |
| 2014-07 | WSW | 7 | WSW | 8 | WSW | 8 | W | 7 | WSW | 7 | W | 8 | W | 9 | W | 10 | W | 9 | W | 9 | WSW | 11 |
| 2014-08 | WNW | 15 | W | 14 | W | 9 | W | 4 | VRB | 2 | S | 4 | WSW | 6 | W | 7 | W | 9 | W | 10 | WSW | 9 |
| 2014-09 | NW | 8 | NW | 8 | NW | 10 | NW | 9 | WNW | 8 | WNW | 6 | N | 4 | E | 3 | S | 7 | W | 9 |  |  |
| 2014-10 | S | 6 | S | 7 | S | 7 | WSW | 5 | WSW | 4 | SSW | 4 | VRB | 2 | W | 3 | WNW | 5 | W | 7 | W | 5 |
| 2014-11 | E | 7 | W | 5 | N | 8 | SSW | 3 | NNE | 3 | VRB | 2 | CALM | 0 | S | 3 | VRB | 2 | N | 3 |  |  |
| 2014-12 | E | 4 | E | 3 | VRB | 2 | VRB | 1 | W | 5 | N | 5 | NNE | 4 | NNW | 4 | WNW | 6 | NW | 7 | NW | 6 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 1** | | **Day 2** | | **Day 3** | | **Day 4** | | **Day 5** | | **Day 6** | | **Day 7** | | **Day 8** | | **Day 9** | | **Day 10** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2015-01 | NW | 03 | VRB | 01 | N | 04 | ENE | 04 | ESE | 04 | VRB | 02 | N | 04 | N | 04 | ENE | 05 | E | 05 |  |  |
| 2015-02 | SE | 03 | E | 05 | ENE | 08 | ENE | 03 | NE | 04 | N | 03 | N | 03 | N | 05 | NE | 05 | NNE | 04 |  |  |
| 2015-03 | SSE | 04 | WNW | 03 | NNW | 04 | VRB | 02 | NE | 04 | NE | 05 | NNE | 05 | NNE | 04 | ENE | 04 | ENE | 03 |  |  |
| 2015-04 | ENE | 04 | E | 03 | NNW | 03 | NNW | 05 | N | 03 | NW | 04 | NW | 05 | NNE | 03 | ENE | 04 | E | 05 |  |  |
| 2015-05 | W | 3 | W | 4 | WNW | 4 | W | 3 | WNW | 4 | SW | 5 | W | 7 | W | 7 | W | 8 | W | 7 |  |  |
| 2015-06 | SW | 7 | SW | 6 | SW | 7 | W | 11 | SSW | 7 | SSW | 9 | SSW | 12 | WSW | 8 | WSW | 4 | SW | 5 |  |  |
| 2015-07 | WNW | 6 | NW | 5 | WNW | 7 | WNW | 9 | NW | 10 | NW | 10 | WNW | 9 | WNW | 6 | W | 7 | W | 9 |  |  |
| 2015-08 | NW | 5 | NW | 6 | WNW | 5 | W | 8 | WNW | 7 | WNW | 8 | WNW | 9 | WNW | 11 | WNW | 12 | WNW | 12 |  |  |
| 2015-09 | NW | 9 | NW | 7 | NW | 10 | NNW | 6 | NW | 5 | W | 4 | WSW | 6 | WSW | 6 | W | 5 | WSW | 6 |  |  |
| 2015-10 | SSW | 6 | SW | 6 | W | 5 | WNW | 7 | W | 9 | W | 8 | WSW | 8 | WSW | 11 | SW | 11 | WSW | 7 |  |  |
| 2015-11 | W | 7 | S | 5 | S | 4 | W | 5 | NNW | 4 | NNW | 5 | W | 5 | NNW | 6 | WNW | 4 | WNW | 5 |  |  |
| 2015-12 | VRB | 2 | WNW | 4 | WNW | 7 | N | 7 | N | 5 | ENE | 5 | NE | 4 | ENE | 5 | SSE | 5 | SSE | 5 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 11** | | **Day 12** | | **Day 13** | | **Day 14** | | **Day 15** | | **Day 16** | | **Day 17** | | **Day 18** | | **Day 19** | | **Day 20** | |  |  |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |  |  |
| 2015-01 | E | 06 | E | 06 | ENE | 04 | ENE | 05 | ENE | 06 | E | 06 | E | 05 | ENE | 05 | E | 04 | E | 06 |  |  |
| 2015-02 | NNE | 05 | NE | 04 | N | 04 | NNE | 05 | NNE | 05 | NNW | 04 | NNW | 03 | VRB | 02 | VRB | 02 | NE | 05 |  |  |
| 2015-03 | ENE | 04 | NNE | 04 | NW | 05 | ENE | 06 | E | 07 | ESE | 06 | E | 03 | W | 03 | NW | 03 | NNW | 03 |  |  |
| 2015-04 | SSE | 04 | SSW | 03 | VRB | 02 | WSW | 04 | WSW | 03 | W | 04 | W | 07 | NNW | 04 | VRB | 02 | VRB | 02 |  |  |
| 2015-05 | W | 5 | WNW | 8 | WNW | 10 | NW | 9 | NW | 7 | W | 10 | W | 7 | WSW | 8 | WNW | 7 | W | 4 |  |  |
| 2015-06 | WSW | 7 | W | 6 | W | 8 | W | 7 | W | 8 | W | 8 | W | 9 | W | 10 | W | 10 | W | 10 |  |  |
| 2015-07 | W | 10 | WNW | 8 | NW | 11 | NW | 14 | NW | 13 | WNW | 13 | W | 10 | W | 8 | WNW | 10 | WNW | 9 |  |  |
| 2015-08 | WNW | 10 | W | 7 | NW | 11 | WNW | 8 | NW | 7 | NW | 8 | NNW | 11 | NW | 11 | NW | 7 | W | 5 |  |  |
| 2015-09 | W | 8 | W | 6 | W | 5 | W | 6 | W | 9 | WNW | 10 | NW | 11 | WNW | 12 | WNW | 11 | WNW | 13 |  |  |
| 2015-10 | W | 5 | VRB | 2 | N | 3 | E | 3 | SE | 4 | SE | 4 | VRB | 2 | VRB | 2 | VRB | 2 | E | 5 |  |  |
| 2015-11 | NNW | 4 | SW | 6 | NNW | 5 | NW | 5 | NW | 5 | W | 5 | WNW | 6 | W | 7 | W | 5 | SE | 4 |  |  |
| 2015-12 | SE | 5 | SE | 4 | S | 3 | VRB | 2 | VRB | 2 | N | 4 | E | 4 | SSE | 4 | E | 6 | E | 7 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Years & Months** | **Day 21** | | **Day 22** | | **Day 23** | | **Day 24** | | **Day 25** | | **Day 26** | | **Day 27** | | **Day 28** | | **Day 29** | | **Day 30** | | **Day 31** | |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |
| 2015-01 | E | 06 | ENE | 05 | NE | 05 | ENE | 04 | NE | 04 | E | 03 | E | 04 | E | 04 | NNE | 04 | ENE | 06 | E | 04 |
| 2015-02 | E | 06 | ENE | 05 | E | 04 | NNE | 05 | NNE | 05 | E | 04 | E | 04 | SSE | 05 |  |  |  |  |  |  |
| 2015-03 | ENE | 05 | E | 04 | NE | 04 | N | 05 | NNW | 03 | E | 03 | N | 03 | NNE | 04 | NNE | 04 | ENE | 03 | NE | 03 |
| 2015-04 | SSW | 03 | VRB | 02 | WNW | 04 | W | 05 | NW | 03 | NE | 03 | VRB | 02 | VRB | 02 | VRB | 01 | W | 03 |  |  |
| 2015-05 | W | 5 | WSW | 5 | WSW | 6 | SW | 6 | W | 6 | WSW | 6 | W | 5 | W | 5 | WNW | 8 | W | 6 | WSW | 7 |
| 2015-06 | W | 10 | WSW | 9 | SW | 7 | SW | 8 | WSW | 8 | W | 12 | W | 12 | W | 11 | W | 9 | W | 7 |  |  |
| 2015-07 | WNW | 9 | WNW | 12 | WNW | 11 | WNW | 9 | WNW | 9 | W | 5 | NW | 4 | VRB | 2 | VRB | 1 | VRB | 1 | VRB | 2 |
| 2015-08 | NW | 5 | NNW | 4 | WNW | 4 | NW | 6 | NNW | 6 | NW | 6 | WNW | 8 | NW | 5 | NW | 5 | W | 6 | NNW | 7 |
| 2015-09 | WNW | 11 | W | 10 | WNW | 10 | NW | 9 | NW | 9 | NW | 7 | NW | 7 | NW | 6 | WNW | 6 | W | 5 |  |  |
| 2015-10 | SSE | 5 | SSE | 6 | S | 4 | S | 8 | SW | 7 | SW | 8 | W | 6 | VRB | 2 | NW | 3 | NW | 6 | WSW | 4 |
| 2015-11 | SSE | 5 | E | 4 | S | 5 | E | 6 | E | 7 | E | 4 | WSW | 4 | NE | 4 | E | 3 | W | 3 |  |  |
| 2015-12 | E | 7 | ENE | 6 | E | 5 | E | 4 | ENE | 5 | ENE | 7 | ENE | 5 | E | 8 | E | 11 | E | 9 | E | 9 |

**Wind frequency Distribution from 2010 - 2015**

**H.Dh. Hanimaadhoo**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2010** | | **2011** | | **2012** | | **2013** | | **2014** | | **2015** | |
| **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** | **Dir** | **Spd** |
| ENE | 5 | NNW | 3 | N | 5 | ENE | 5 | E | 5 | E | 4 |
| ENE | 5 | N | 3 | N | 5 | E | 4 | E | 5 | NNE | 4 |
| ENE | 5 | NW/WNW | 5 | NW | 4 | NNW | 4 | E | 5 | ENE | 4 |
| W | 5 | W | 5 | WNW | 5 | NW | 5 | W | 5 | VRB | 3 |
| WSW | 8 | W | 7 | WNW | 6 | W | 8 | W | 5 | W | 6 |
| W | 9 | W | 10 | W | 9 | W | 10 | WSW | 10 | W | 8 |
| W | 9 | W | 8 | W/WNW | 10 | W | 8 | W | 10 | WNW | 8 |
| WNW | 10 | W | 8 | W | 7 | WNW | 9 | W | 8 | NW | 7 |
| W | 7 | W | 7 | W | 6 | W | 8 | NW | 7 | NW | 8 |
| W | 7 | W | 5 | NW | 5 | W | 7 | W | 5 | W | 5 |
| WSW | 5 | E | 5 | VRB | 3 | E | 4 | W | 5 | W | 5 |
| WSW | 3 | E | 4 | E | 5 | E | 5 | E | 4 | E | 5 |
| **W** | **7** | **W** | **7** | **W** | **6** | **W** | **7** | **W** | **7** |  | **7** |

4.6 **General Conditions of Waves**

Wave condition at Maldives is rather moderate. No serious cyclone is recorded. The swells and wind waves experienced by the Maldives are conditioned by the prevailing biannual monsoon wind directions, and are typically strongest During April-July in the SW monsoon season. During this season, swells generated north of the equator with heights of 2-3 m with periods of 18-20 seconds have been reported in the region. However, the Maldives also experiences swells originating from cyclones and storm events occurring well south of the equator.

1. ENVIRONMENTAL REQUIREMENTS

5.1 Introduction

The proposed construction works are, under conditions given below, expected to have only minor impact on the surrounding coastal zone.

However, this is to be expected only if relevant mitigation measures are incorporated during the construction phase as well as during the long term operational period. In this section the objectives, obligations and criteria of such mitigation measures will be outlined.

* 1. Feedback Monitoring

During the period of dredging and reclamation, working activities may have adverse effects on the coral reef community and the terrestrial coastal zone. One of the main activities will be the dredging of basin for the reclamation.

The most widespread and visible consequence of dredging and excavation is the generation of suspended sediments and turbidly, both of which affect the corals adversely.

Other main activities with possible adverse effects are the disposal of the dredge spoils, site clearance on land and transport on land and at sea.

The Contractor shall during the construction period carry out an environmental control programme following a feedback design in order to ensure that adverse effects are detected before they become irreversible; The basic concept of a feedback monitoring program is that selected environmental key criteria, for instance live coral coverage or sedimentation rates, are observed regularly during the construction phase. If response, based on impact criteria indicating thresholds severe but yet not irreversible levels of impact, are crossed, steps of avoidance shall be enforced.

A metrology description for the environmental migration measures proposed for the environmental control programme shall be prepared by the Contractor for the Owners approval prior to the implementation of the environmental control programme and prior to any construction works on site.

The environmental key criteria and possible response thresholds are specified in the following sections.

* 1. Operational Key Criteria for Acceptable Environmental Impact

During construction the response on the following operational key criteria for acceptable environmental impact shall be measured at the perimeter of the construction zone. The perimeter of the construction zone shall be clearly identified at site and shall be approved by the Consultant / Engineer before taking of the measurements.

The Response Threshold (RT) for the operational key criteria shall be:

1. Live coral coverage; No significant decrease shall occur at selected sites, representative of the coral reef community in the area, compared to likewise representative reference sites.
2. Concentration of suspended solids in surface waters over reef slope: less than 10 mg/l above ambient concentration during daylight hours and less than 20 mg/l at night.
3. Sedimentation rate on coral reef slope (5-10 m depth zone): less than 10 mg/cm2 day.
   1. Environmental Obligations

The Contractor has the obligations mentioned below. He shall address the issues in the methodology description for his environmental mitigation measures designed to meet the criteria mentioned in section 4.3 and the subjects listen in section 4.5:

* 1. To describe methodology of, and carry out, an appropriate feedback monitoring programme, and see that the response thresholds given above are not surpassed. For this programme detailed and currently updated dredging schedules should be given currently calculate the amount of spill.
  2. To describe, how possible adverse impacts related to subjects listed in section 4.5 are planned to be migrated.
  3. Establish emergency measures and procedures for accidental spills of hazardous substances during the construction period.

1. Make an assessment of the possible impact of any temporary physical structure on the hydraulic situation and any possible erosion following this, and take mitigation constructions into the planning of the dredging and reclamation.
2. Report to the Owner.
   1. Subject of Environmental Concerns

The following list included subjects considered of environmental relevance for the construction or part thereof. The list shall be considered as guideline for the contractor in his selection of mitigating measures of relevance for his selected construction methods and they shall be subject to adjustment when experience obtained during the environmental feedback monitoring program should call for this.

1. Dredged material. Dredged material to be used for consumption purposes must not be deposited on the reef flats or on landsides areas outside the limit of working areas. The excavation scheme should be set up in such a way that slurry plumes are minimised as much as possible on and in the vicinity of the reefs.
2. Surface run off. During the construction period surface Water caused by heavy rainfall may carry larger amounts of sediment to the reefs. Such surface run off shall be minimized.
3. Fresh water supplies for any construction purpose or labour force are to be brought in by the Contractor.
4. Solid waste and sewage: as a main principle, all waste is to be removed from the island before any nuisance of dust, smell or visibility is generated.
5. Waste: waste oil from machinery, bilge pumping or other use as well as any waste of hazardous substances connected to the construction activities is to be collected and transported as directed by the Consultant / Engineer.
6. Dumping: No dumping of any kind from support vessels are allowed on the reef or in the upstream waters of the island (and should otherwise follow any national regulations on dumping.
7. Dust nuisance: Activities creating dust nuisance are to be conducts under wind conditions that can the dot out to sea.
8. Anchoring of carrier and supporting ships and vessels: anchor is not allowed to be

dropped on the reef crest or reef slope outside the working areas limit.

* 1. The Contractor's Setting Out

Ground markers shall be established for the above-mentioned main reference lines. The Contractor shall protect, and maintain these permanent pound markers during the period of the Contract. The Contractor shall install, protect, and maintain during the period of the Contract, such additional permanent and/or temporary pound markers as are necessary for the execution of the Works, or as required by the Consultant / Engineer.

Sufficient working space shall be available around each pound marker to enable the Survey instruments to be erected and operated.

Further requirements regarding setting out, survey, etc. of the structures are stated in the specifications of the structures.

* 1. Survey of Sea Bed – “In survey”

Initial surveying of the sea bed are required prior to any dredging or reclamation works.

The areas shall, in connection with in- and out-surveys, extend to cover at least 100m of the seabed beyond all dredging and reclamation limits in addition to the actual dredging/reclamation area.

The Contractor shall provide all necessary equipment, instruments, labour and crew necessary for bathymetric and pound surveys including an echo-sounder, to be available on Site for the entire period while dredging is carried out. The instrument shall record soundings with a horizontal accuracy of ±1.0 m and a vertical accuracy of ± 0.10 m, for depths of 2 to 30 m. The survey set-up shall as a minimum include, but is not be limited to, positioning system, echo-sounder, heave-compensator, gyro-, pitch- and roll Sensors and sound-velocity probe. The survey shall be made through sounding in a grid of maximum 10m spacing between the survey lines in both directions.

The survey shall be detailed sufficiently for the recording of any major irregularities in the surveyed surface.

The Contractor shall shortly before the execution of any substantial survey work carry out calibration of is survey equipment in order to document that his setup can meet the specified requirements to surveys.

Maps shall be produced of all surveys in scale 1:1000 or 1:500, as approved by the Consultant / Engineer.

In addition to the specified Maps, raw data shall be made available to the Consultant / Engineer. The format in which the data shall be submitted shall consequently be final XYZ “raw” data in ASCII format. These data must be identical to those used by the Contractor as input in his final model and have consequently been corrected for erroneous reading, for odd-set gyro, pitch and roll and for off-set in the relation to vertical datum.

1. DREDGING , RECLAMATION AND EARTH WORKS

6.1 Scope of works

The works decided in this section of the specifications comprise dredging for:

Dredging areas, dredging depths and dredging limits are specified in the DWG-REC/01/16, DWG-CS/01/16

The specified works comprise in addition use of dredged materials for fill in reclamation areas and other parts of the stockpile area specified by the Consultant / Engineer for utilisation elsewhere on the island.

Areas required for Reclamation, fill and backfill works are specified on drawings provided with the document.

Areas proposed to excavate from the existing land are shown in the drawing. Estimated volume of fill required for the Airport is estimated as 276,908 cubic meter. The borrow areas from existing land may be possible in the areas shown in the drawing. Contractor is responsible to examine the borrow areas, investigate soil and submit the soil investigation report for the approval. If the quantity is not sufficient to organise filling areas shown in the drawing from the borrow areas the remaining quantity shall be completed at contractor’s own cost.

Fill above the HIGHEST WATER LEVEL to the bottom sub base layer (approximately 600 mm), coral material shall be placed in level, horizontal layers not exceeding 0.3 metre (loose measurement) thick and be compacted as specified before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain a uniform thickness prior to compacting. As the compaction of each layer progresses, levelling and adjustments shall be performed continuously to ensure uniform density. Refer DWG-CS/02/16.

Material containing more than 25 per cent of large pieces of coral with the greatest diameter of more than 150 mm, and which cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, shall be removed and used for Some other purpose.

The dredging works consists of excavation of coral materials below the existing seabed regardless of the nature of the materials encountered during the course of dredging. Disposal of dredged material at either Stockpile or as fill, backfill, reclamation filling or core and filter materials in Runway structures, shall be carried out in accordance with these specifications and in compliance with the drawings as directed by the Consultant / Engineer.

The works include supply of all materials and the provision of all labour, plant and equipment required for the actual dredging, reclamation and other reuse of dredged materials as well as for all preparatory works surveys and testing required for the proper execution and completion of the works. In addition the works shall include all required measures for reduction of the environmental impact of the dredging and be included in the Contractors Environmental Control Programme according to the specifications in Section II.

6.2 **References**

The following Standards and Codes of Practice are referred to in this specification and fully or partly incorporated herein as specified:

Designation Title of Standards / Code of Practice

BS 812 Sampling and Testing of Mineral Aggregates, Sand and Fillers

BS 6349, Part 5 Maritime structures. Code of Practice for dredging and land reclamation

CIRIA/CUR: Manuel on the use of rock in coastal and shoreline Consultant / Engineering. Report no. 83/154

6.3 **Utilization of Dredged Materials**

All suitable material removed from the dredging areas shall, subject to the approval by the Consultant / Engineer, either be initially sorted by excavator and manual labour or by means of grizzly plant and/or hauled to a stockpile for screening, or shall be used for reclamation, subgrade for paving work, backfill for structures, or for other purposes shown on the drawings or as directed. Materials which are otherwise suitable but contain excess moisture shall be processed and utilized for fill.

Material from the dredging determined by the Consultant / Engineer as suitable for slope protection in revetments, filter or core material or other purposes shall be conserved and utilized as directed.

Materials from the dredging determined by the Consultant / Engineer to be for use in the Works shall be disposed of at the designated stock-pile areas or other areas approved by the Consultant / Engineer. Unless otherwise specified, compaction will not be required. However, the materials taken to disposal areas shall be levelled and shaped attractively to the approval by the Consultant / Engineer.

All excess material shall be delivered for other utilization on the island or disposed of as directed. It is the Contractor's responsibility to determine if sufficient material is available for the completion of the works before delivering or disposing of any materials. Any shortage of suitable materials for Completion of the work caused by premature disposal of materials by the Contractor shall be replaced by the Contractor at no cost to Owner.

6.4 **Materials**

The density of coral sand may be ranging from 23 to 26 kN/m3. It is estimated that the average density for coral sand and gravel from Lagoon is 24 kN/m3.

The density for coral varies considerably with the type and quality of the coral. It is estimated to 22 kN/m3. The loose state density shall not be less than 800kg/m3 and the maximum dry density of dredged materials shall not be less than 1.7 g/c m3 for reclamation of land.

Actual geotechnical parameters including specific gravity and density of dredged materials reused in the reclaimed structures shall be verified according to the function of the materials used in the structures and the specified quality requirements.

6.5 **Testing of Materials**

Dredged materials shall be tested for registration of dredging classes shall include the cost in the price proposal.

Testing of dredged material used as fill for general reclamation and as backfill shall be in accordance with the Specification for Highway Works: 1994 - Department of Transport, London.

Testing will further be required when the dredged material is reused in the construction works. This testing shall provide sufficient documentation of the material quality and ensure fulfilment of all requirements specified for the material when used in the actual structures.

6.6 **Workmanship**

6.6.1 **Setting out of Dredging Works**

Al1 boundaries of dredging areas shall be established on the site by installation of marked in the appropriate reference lines or electronically established subject to the Consultant / Engineer's approval.

Markers shall be robust and clearly visible from all parts of the repairing area.

Al1 setting out of dredging works shall be carried out by the Contractor.

* + 1. **Execution of dredging**

A1l dredging sort and earthworks shall be carried out in compliance with the criteria and environmental mitigating measures outlined in Chapter 4.

Prior to dredging or disposal of materials in any area, such area shall be cleared and its surface level shall be surveyed in the presence of the Consultant / Engineer. The survey shall be made sounding in a grid of maximum 10m spacing between the surrey lines in both directions.

The survey shall be detailed sufficiently for the recording of any major irregularities in the surveyed surface.

All materials dredged as specified on the drawings or as directed by the Consultant / Engineer shall be utilized as specified in 5.3.

The Contractor shall notify the Consultant / Engineer min. 48 hours in advance of dredging or disposal of materials in any area.

Dredging shall be carried out by using a backhoe, cutter suction dredger or other dredging equipment with sufficient capacity to dredge the dredging classes 1 thorough 3.

If the Contractor decides upon using a cutter suction dredger or similar equipment, he shall be obligated to familiarise himself with the local conditions on shore to prepare for the necessary arrangements of the spoiling area. Reference is moreover made to the environmental requirements as described in Section 3.

Pre-splitting methods for dredging in soils of class 4 shall be subject to the Consultant / Engineers acceptance. The Contractor is required to provide detailed dredging plans and adequate descriptions of solution and mitigating measures when it is found that pre-splitting is require; for the dredging. It shall be noted that blasting is not encouraged from an environmental point of view and it shall only be allowed after specify permission from the Government of the Maldives has been obtained.

The Consultant / Engineer may order the method of pre-splitting to be stopped if the materials encountered no longer warrant it.

The supply, placement and compaction of fill and backfill specified on Drawing No. DWG-REC/01/16, DWG-CS/01/16 & DWG-CS/02/16 shall be in accordance with the Specification for Highway Works: 1994 - Department of Transport, London, unless otherwise permitted, fills and backfill materials from dredging work shall contain no organic or other deleterious matter. Rock or other solid matter may be placed in a reclamation area subject to the Consultant / Engineer's approval. Bulky materials shall not be used as reclamation materials.

For reclamation below HIGHEST WATER LEVEL, dredged materials shall be placed directly in reclamation areas as shown on the Drawings. Large pieces of coral deposited in reclamation areas shall be spread over the full width of the reclamation area with sufficient small coral pieces or other fine material used to fill the voids in order to produce a dense, compact reclamation.

For reclamation above the HIGHEST WATER LEVEL, coral material shall be placed in level, horizontal layers not exceeding 0.3 metre (loose measurement) thick and be compacted as specified before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain a uniform thickness prior to compacting. As the compaction of each layer progresses, levelling and adjustments shall be performed continuously to ensure uniform density.

Material containing more than 25 per cent of large pieces of coral with the greatest diameter of more than 150 mm, and which cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, shall be removed and used for Some other purpose.

6.7 Tolerances

Dredging shall be carried out to the designated depths in all parts of dredging areas with a maximum permissible over dredging of 0.3 m below the specified level (Maximum Depth) unless noted otherwise by or as agreed with the Consultant / Engineer.

Excess dredging below Maximum Depth is not accepted unless approved by the Consultant / Engineer and shall be replaced by suitable material at no cost to the Owner.

The tolerances relative to the Specified Depth for dredging of areas in general is +0 mm to 300 mm.

The natural unprotected profile of slopes resulting from the dredging has in general been indicated as 1:3 reflecting the expected result of dredging in sand and gravel exposed to moderate wave impact only.

6.8 **Inspection**

6.8.1 **General**

The Contractor shall, prior to commencement and after completion of dredging works carry out surveys of the respective areas (in-survey and out-survey)

* + 1. **In-survey of Existing Bottom or Ground**

An area covering the entire working area, as shown in shall be surveyed.

Maps and "raw" data shall be submitted to the Consultant / Engineer not later than one week after the scheduled execution of the in-survey.

* + 1. **Inspection after Completion**

The Contractor shall verify that the dredging has been carried out as required.

Supplementary verification of areas dredged to a specified level shall be carried out by suspending a 6 to 10 m long straight edge (rail) from a boat, so that the underside of the straight edge is horizontal and level with the indicated dredging level. A sounding rod shall extend vertically above the water table in order to disclose the vertical movements of the straight edge. The boat shall move slowly across the area in a manner which ensures that the total area is covered by the straight edge. Areas where the straight edge cannot pass freely shall be marked with buoys and the necessary corrections of the seabed carried out.

The verification of slopes shall be made by soundings.

Maps and "raw" data shall be submitted to the Consultant / Engineer not later than two weeks after the execution of the respective survey.

**EMPLOYER’S REQUIREMENTS**

Preliminary Reclamation depth assumed as 1.4 m from M.S.L. to all areas covered in the scope.

Submit

* Source of Material ( location of barrow areas ) Barrow areas shall be finalized with inclusion of Entrance Channel and Jetty areas where natural access is not available.
* Details of proposed equipment to carry out the works.
* Method statement

1. Method statement, including;

* Proposed equipment for the works if required

1. Project costing;

* A BOQ for tender purpose is attached in the document to estimate the project cost. Contractor is responsible to check the accuracy of the quantities before submission of the bid. Additional claims to be made during and after the completion of Project.

1. Work schedule;

The contractor shall submit proposed work schedule. The work schedule shall indicate the major works to be carried out under the scope of the project. The work schedule shall clearly show the proposed date for the start of work on site.

### Other Information

1. It is contractors’ responsibility to obtain all the permits required (from regulatory authorities, service providers etc.) for dredging and reclamation works.
2. The metric system of units shall be used throughout.
3. The maximum advance payment is 15% would be released on submission of a Bank Guarantee equal to the amount as specified in the contract.

**Note.**

All approvals required in relation to the project shall be the responsibility of the contractor including Environmental Impact Assessment.

**Section – II**

**Bills of Quantities**

**Section – III**

**Drawings**