CONCEPTUAL DRAINAGE STRATEGY

Thurrock Flexible Generation Plant, Tilbury

Application document number A7.3

APFP Regulations reference5(2)(q)

Thurrock FGP, Tilbury
Conceptual Drainage Strategy
P065
10th May~~04th November~~ 20210

Report Refence:
019512-RPS-XX-XX-RP-D-0300

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
P01	For Information	LJS	DW	DW	24.10.19
P02	For Information	LJS	DW	DW	16.12.19
P03	For Information	CW	LJS	DW	17.02.20
P04	For Information	CW	DW	DW	16.10.20
P05	For Information	CW	DW	DW	04.11.20
P06	For Information	GB	DW	GB	10.05.21

Approval for issue

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1 INTRODUCTION

1.1 RPS has been commissioned by Statera Energy to produce a Conceptual Drainage Strategy in support of a Development Consent Order (DCO) application for a proposed Flexible Generation Plant (FGP) in Thurrock Essex.

1.2 The proposed development site, approximately 20ha in size, comprises a new gas fired power and battery storage facility together with gas connection compound and other associated plant infrastructure on the main development site for the facility:

- Gas engines, air pollutant control and cooling
- Gas connection compound (main site)
- Substation
- Battery Storage
- Carbon Cc apture Ready Area
- Access ~~Track~~ Roads and Soft Landscaping

1.3 In addition to the main development site, private access roads would be constructed from Fort Road and Station road to the site (including utilising sections of existing road via Tilbury2 and RWE's former Tilbury Power Station site) and a circa 2 km gas pipeline to a connection point with the national gas transmission network would also be put in place.

~~1.3~~1.4 The site will be fully secured against access by the general public and will have a staff of four to six full-time equivalent (FTE) at the main development site~~in general not be manned~~.

~~1.4~~1.5 The purpose of the Conceptual Drainage Strategy is to outline the design principles for surface water drainage to be adopted for the development of the site. This report has been produced in conjunction with an RPS Flood Risk Assessment contained within Volume 6, Appendix 15.1: Flood Risk Assessment of the Environmental Statement (application document A6).

~~1.5~~1.6 The contents of this report are to be read in conjunction with all supporting drawings and/or documents referenced herein, appended to this report or submitted in support of the DCO application for this development.

Site Description

~~1.6~~1.7 The site is located in Thurrock, Essex and consists of approximately 20ha agricultural land, which is split into two distinct fields, north and south, by a land drainage ditch, see RPS drawing 019512-RPS-SI-XX-DR-D-0300.

~~1.7~~1.8 The Site is bound by agricultural land to the east and west, with an existing National Grid substation on the southern boundary. The River Thames is situated approximately 1km south of the Existing substation. Vehicular access to the site is via an existing access track to the north east which connects to Station Road.

~~1.8~~1.9 More information regarding the site location and description can been found in Volume 2: Project description of the Environmental Statement (application document A6).

~~1.9~~1.10 A topographical survey carried out by Survey Solutions dated 28/02/2018, confirmed an average site level of approximately 1.5m AOD. The survey indicates the north field to have a gentle slope from the northwest to the southwest, c.1.4m AOD to c.1.23m AOD and the south field to fall from west to east. c.1.55m AOD to c.1.3mAOD. Some localised raised areas up to 1.8mAOD are also identified in the survey.

~~1.10~~1.11 The site and its immediate surroundings are farmland, therefore surface water drainage provisions which currently exist are limited to local field drains / open ditches and/or minor watercourses laid to the perimeter of existing fields.

Ground Conditions

~~1.11~~1.12 A Phase 2 site investigation was carried out by TerraConsult Ltd to provide information on the condition of the site prior to application for an Environmental Permit. This report contained a summary of the following encountered ground conditions;

- Topsoil
- Made Ground
- Alluvium
- Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation

~~1.12~~1.13 More information regarding the location and depths of the encountered ground conditions can be found in the TerraConsult Ltd. Phase 2 Site Investigation Report, Report No 4593/R01 Issue 1.

2 PROPOSED SURFACE WATER DRAINAGE

2.1 The proposed new surface water drainage system will be designed using current MicroDrainage Design software by Innovyze, to take account of planning guidance, Lead Local Flood Authorities (LLFA) and Environment Agency (EA) guidance to prevent uncontrolled flooding of the site and surrounding areas.

2.2 Due to the nature of the DCO application, the final site layout will be determined within the limits of deviation. At this stage, the drainage strategy for the site has been carefully devised achieve a strategy which adequately manages water quality, water quantity and promotes biodiversity whilst accommodating design flexibility that the DCO and limits of deviation allow. This strategy will be refined at detailed design stage.

In the absence of a finalised site plan, proposals to manage water quality, water quantity and promote biodiversity have been developed conceptually at this stage using an indicative areas plan. The Indicative Drainage Areas plan has been included in Appendix A.

2.3 Surface water runoff from the proposed development areas will be managed as follows:~~;~~

Main development site

- Permeable surfaces
  - **Soft Landscaping** – any grassed landscaped areas will drain directly to one of the onsite attenuation basins or any of the series of ditches on the site.
  - **Unbound site access roads** – access roads will primarily be constructed using compacted ~~of~~ unbound granular materials laid to a crossfall and will therefore generate similar runoff volumes to the naturally occurring clay subgrade. Runoff from these areas will drain directly ~~as existing~~ to either of the attenuation basins or~~,~~ ditches, where these lie directly adjacent to a road. Where this is not possible, a lateral ~~or~~ filter drain with perforated pipe will be provided to roadways which will act to intercept runoff and direct flows to the attenuation basins~~s~~.
- Semi-permeable surfaces
  - **Gravelled plant compound areas** – Runoff will percolate into a surfaced~~the~~ gravel layer which will be laid to crossfalls to a network of filter drains. A perforated pipe will then carry generated flows to the attenuation basins. The exact arrangement of smaller plant and battery units in these areas is currently unknown. This area has been conservatively assumed to be 50% impermeable surfacing.
  - **Carbon capture** – The areas allocated for carbon capture have been bound by a series of land drainage ditches to intercept overland flows. These ditches will then convey runoff towards the attenuation basins. The exact makeup of these areas is currently unknown and therefore

this area has been conservatively assumed to be 50% impermeable surfacing.

- Impermeable surfaces
  - **Plant areas** – It is envisaged that gas reciprocating engines will be located on isolated concrete slabs. The slabs will be laid to crossfalls which direct surface water runoff to a collector channel or ~~/~~ slot drain. After passing through a proprietary oil interceptor, surface water will then be directed towards the attenuation basins. Penstocks will also be provided at these locations to allow for containment of spillages.

Gas connection compound (national transmission network connection)

2.4 As set out in the development application, this will be a gravelled compound with an above-ground section of pipeline for maintenance access to the connection, instrumentation kiosks/cabinets and inspection equipment. The compound is not expected to include buildings but may have a container or similar for equipment storage. Surface water runoff will be managed as follows –

- **Gravel compound area** – Runoff will percolate into a surfaced gravel layer which will be laid to crossfalls to one or more filter drains. A perforated pipe will then allow direct infiltration into the ground. Surface water attenuation will be achieved within the gravel surfaced areas and filter drainage trenches.

- **Control equipment / storage units** – It is envisaged that small modular type cabinets and containers will be located on isolated concrete pads or on localised support plinths with nominal impermeable area. Surface water runoff from these areas will percolate directly into the surfaced gravel areas adjacent to these installations, and be disposed of as described above.

Access roads

2.5 There will be two permanent access roads to the main development site. The first will be from Station Road, likely to follow approximately the course of the existing farm access track to the site. The second will be from Fort Road, largely utilising existing roads on the Tilbury2 and RWE sites but requiring new road sections from a junction at Fort Rd and from the RWE site to the Thurrock FGP main development site.

2.6 The area of work will depend on the final design, with several options possible within the limits of deviation as shown on the Works Plans and described in the application, but the total length of new road constructed is likely to be approximately 2km assuming a typical width of 6m which would generate an area of 12,000m^2. Surface water runoff will be managed as follows –

- **Unbound / bound site access roads** – access roads will primarily be constructed using asphalt concrete or compacted unbound granular materials laid to a crossfall for drainage and will therefore generate similar runoff volumes to the naturally occurring clay subgrade. Runoff from new and improved access roads will drain to a lateral filter drain or open vee-ditch constructed within the road verge to receive surface water runoff, and allow attenuation and infiltration of surface water

runoff. Filter drains will be fitted with perforated pipes to facilitate direct infiltration.

2.7 Due to relatively poor ground conditions on the site it is expected that all new road construction will require to be constructed on a significant thickness of foundation embankment above existing ground level to provide sufficient road stiffness to cater for expected traffic loads. Road embankments will be constructed such that all associated drainage systems can be set above existing groundwater levels to facilitate positive drainage from the road surfaces.

~~2.3~~2.8 The short section of access road (c. 200-300m) from Fort Road to Tilbury2 internal site road will be adjacent to the drainage infrastructure including attenuation pond recently constructed for Tilbury2 and it is anticipated that tie-ins to this infrastructure would be developed.

~~2.4~~ The areas mentioned above for drainage of the main development site have been set out in an Indicative Areas plan included in Appendix A. Based on this plan, a total impermeable area of 63,500m² has been estimated which equates to approximately 32% of the total site area. These figures have been using to calculated site specific runoff coefficients (Cv) of 0.729 Summer and 0.851 Winter for use in the drainage design. Calculations included in Appendix B.

~~2.6~~2.10 For conceptual design purposes the following levels have been assumed:~~;~~

Table 1: Conceptual Design Levels

Conceptual Design levels	
Existing site levels	Average approximately 1.5mAOD
Attenuation Basin cover level	1.75mAOD
Attenuation Basin invert level	0.75mAOD
Outfall to perimeter ditch level	0.5mAOD
Zone A areas including the gas fired facility, battery storage and customer substation	2.0mAOD

Levels to be reviewed during detailed design

~~2.7~~2.11 The proposed level for the gravel compounds and plant areas is set c.500mm below the design flood level for the development. Flood resistant / resilient measures will therefore be incorporated to protect the proposed infrastructure up to this level. Measures may include flood resilient construction and localised bunding. Further details on flood risk and resilience is included in the RPS Flood Risk Assessment contained within Volume 6, Appendix 15.1: Flood Risk Assessment of the Environmental Statement.

Surface Water Quantity

~~2.8~~2.12 Greenfield runoff rates for the site have been calculated for the site using IH124 Methodology within MicroDrainage software and have been included in Appendix B. A SOIL WRAP Class 4 has been selected for the assessment of greenfield runoff rates on the basis of the Terraconsult Phase 2 Site Investigation report 4593/R01. This identifies an average topsoil depth of 386mm where present on site. In all instances the topsoil layer was directly underlain by impermeable Alluvial Clay. In a small number of locations, no topsoil was recorded, instead a surface layer of made ground comprising impermeable Alluvial Clay soil was present. Based on a depth of topsoil less than 40cm with a generally flat, but undulating topography, a Class 2 Water Regime is appropriate. The depth to impermeable horizon is less than 40cm, with a Slope Class less than 2 degrees and Medium Permeability Class being applicable to the vegetated surface layer dictates a WRAP SOIL Class 4 category.

~~2.9~~2.13 Surface water discharge from the site will be controlled to the equivalent greenfield 1 in 1 year event for all return periods up to and including the critical 1 in 100 year +40%cc event through the use of a flow control device. The site 1 in 1 year greenfield rate has been calculated as 56.4l/s.

~~2.10~~2.14 Surface water runoff will be collected as per the methods above and discharged into one of the two on-site surface water attenuation basins, designed in accordance with The SuDS Manual, CIRIA Report C753, 2015. The attenuation basins will provide attenuation of flows and assist with removal of sediments from rainwater runoff. The downstream outlet of the attenuation basin will include a sump / catch pit for removal of silt and debris. Each attenuation basin will provide

adequate storage for all storm events up to and including the 1:100 year return period with an additional 40% for future climate change.

2.112.15 As per the iIndicative areas plan, a proportion of the landscaping areas will drain as per existing arrangements to the perimeter ditches. The runoff from the remainder of the site has been divided between two sub-catchments 1 and 2 which drain to attenuation basins 1 and 2, see RPS drawing 019512-RPS-SI-XX-DR-D-0300. The 56.4l/s discharge rate will therefore be divided proportionally between the attenuation basins to two separate outfalls. The proposed discharge rates from Attenuation basins 1 and 2 are 41.7l/s and 14.7l/s respectively.

2.122.16 Initial attenuation volume estimates indicated that volumes in the region of 20,100m³ would be required to achieve adequate storage to restricted to the greenfield runoff rates. This figure has also been dived proportionally between the two site catchments so that Attenuation basin 1 and Attenuation basin 2 each provide approximately 17,000m³ and 4,500m³ attenuation volume respectively.

2.132.17 Preliminary calculations have been undertaken using MicroDrainage Software and included as Appendix B. These calculations demonstrate that both Attenuation basins 1 and 2 have adequate capacity to attenuate flows from all storms up to and including the 1 in 100 year storm including a 40% allowance for climate change.

2.142.18 The outfalls to the perimeter drainage ditches will be fitted with non-return valves to prevent the ingress of water should the water level in the ditch rise. Due to the distance from the Thames it is not considered likely that the outfall would be submerged for long periods due to tidal influences. In the event that an excessively high tide prevents an outfall from the site for a prolonged period, the site will be allowed to flood as it would in its undeveloped state. Any flooding which occurs due to a submerged outfall is not likely to cause significant disruption as this will be lower than the 2.5mAoD flood resilience level determined by the FRA for the Tidal breach scenario.

2.152.19 The proposed surface water drainage layout is shown on RPS drawing 019512-RPS-SI-XX-DR-D-0300 - Indicative Drainage Layout, which is included in Appendix A.

Surface Water Quality

2.162.20 Proposed run-off quality control for the Thurrock FGP Site will include a combination of proprietary pollution interceptors, filter drains, open channels and attenuation basins arranged in a format relative to the pollution hazard level of the different site areas. A general arrangement of these elements has been included as RPS drawing 019512-RPS-SI-XX-DR-D-0300. The exact location and combination of features will be determined in the final Drainage Strategy during detailed design, prior to construction.

2.172.21 A water quality risk assessment has been carried out using the SuDS hazard mitigation indices in accordance with Chapter 26, of The SuDS Manual, CIRIA Report C753, 2015. Under this method of assessment, the worst case area of the development is considered to be the concrete slab, plant areas. Considering the low expected traffic volumes and appropriate containment of any hazardous

substances, the residual pollution hazard level is considered to be medium hazard levels similar to that of a commercial yard.

2.18 A combination of proprietary interceptor units, filter drains and attenuation basins will be the minimum level of water quality control provided to the plant slab areas. The following table demonstrates that the SuDS Mitigation indices provided by the features exceed that of the associated pollution hazard index.

Table 2: Medium Hazard - Pollution Mitigation

	Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Pollution Hazard Indices	Medium	0.8	0.8	0.9
Proposed SuDS mitigation I_1 Bypass interceptor unit	-	0.6	0.5	0.6
Proposed SuDS mitigation I_2 Filter Drain		0.4	0.4	0.5
Proposed SuDS mitigation I_3 Attenuation basin		0.5	0.5	0.5
Total SuDS Mitigation (I_1+0.5xI_2…)		**1.05**	**0.95**	**1.1**

2.20 Any areas at risk of spillages or proposed for storage of hazardous chemicals will be subject to specific appropriate containment measures, regulated though the environmental permit. These additional containment measures will ensure there is no risk of pollution to the surface water drainage system.

SuDS Biodiversity and Amenity

~~2.22~~2.24 The proposed site layout will require infilling of existing land drainage ditches, see RPS drawing 019512-RPS-SI-XX-DR-D-0300. This has been recognised as a potential loss of habitat in an area known to accommodate protected species such as water voles. Working closely with the ecology team, SuDS techniques have been incorporated into the proposed drainage strategy to harness the multiple benefits of SuDS including habitat compensation.

~~2.23~~2.25 The proposed drainage strategy includes several open ditches to replace those lost through the development proposals. These ditches will be designed with integral weir boards to help retain flows and provide a permanent wetted bench for habitat enhancement. Ditches will be constructed with side slopes as steep as ground conditions will allow, preferably 1:1 slopes with a minimum 2m vegetated strip to provide optimum habitat for native species.

~~2.24~~2.26 In addition to the new ditches, the attenuation basins will look provide a continuation of this permanent wetted bench. After vegetation begins to establish, the proposed attenuation basins will resemble Figure 2-1 below. The area above the permanent water level will be utilised as surface water attenuation and will therefore be encouraged to flood during high rainfall events. The reciprocal effect of this will encourage the formation of a marsh like environment similar to that of the surrounding area under tidal influence.

2.27 Proposed ditches and attenuation ~~B~~basins have, where possible, been linked to perimeter ditches through parallel sections to provide a continuation of habitat throughout the site.

~~2.25~~2.28 All new SuDS features should be constructed in accordance with advice contained within CIRIA Report C768, 2017 ‘Guidance on the Construction of SuDS’.

Figure 2-1 Detention Basin with low flow channel

3 SURFACE WATER DESIGN PARAMETERS

3.1 The new surface water drainage system will be designed using current analysis software, MicroDrainage, ensuring planning guidelines are satisfied to prevent uncontrolled flooding of the Thurrock FGP Site and surrounding areas.

3.2 At this stage, preliminary calculations have demonstrated the proposed attenuation basins to provide adequate storage to contain all runoff from the 1 in 100 year rainfall event including 40% allowance for climate change.

3.3 During detailed design, the network of ditches, filter drains and piped network shown indicatively in drawing 019512-RPS-SI-XX-DR-D-0300 will be designed to the parameters, return periods and storm durations included below.

3.4 The drainage network will ensure that no flooding occurs in any area of the site for events up to the 1 in 30 year return period storms. For storms in excess of 1 in 30 year events, controlled temporary overland flooding is permitted with flood depths restricted accordingly to consider Health & Safety using Environment Agency's R&D Technical Report FD2320/TR2, Table 13.1 "Danger to people for different combinations of depth and velocity". Any overland flow will be routed to the onsite attenuation basins. No flooding detrimental to buildings will occur during any storm event as a result of surface water runoff.

Design Parameters

- Rainfall: FEH Data; FEH CD-R version 3 – Grid Ref E 566350, N 176250.
- Design Return Period: 2, 30 and 100 (+40% climate change) years.
- Climate change: rainfall profiles increased by 40% for 100 year return period
- Volumetric Runoff coefficient: 0.729 Summer, 0.851 Winter
- Global time of entry: 60mins for filter drain and gravel areas, 10 mins for plant slab
- Infiltration: Ignore for peak flow design
- Backdrops: Allow in design; maximum depth of 1.5m
- Velocity: 0.75 m/s for self-cleansing (private drainage)

Storm Return Periods and Durations

- 2 year return period – 15mins to 1440mins storm duration
- 30 year return period – 15mins to 1440mins storm duration
- 100 year return period (+40% climate change) – 15mins to 1440mins storm duration

4 PROPOSED FOUL WATER DRAINAGE

4.1 The proposed Thurrock FGP will largely be operated remotely however it is envisaged that staff welfare facilities will be provided for when staff are on site for maintenance or operational needs. The proposed development will not have a sewer connection. Foul drainage from staff welfare facilities on site will be either to a packaged biological foul treatment plant with discharge to the surface water system or to a storage tank for off-site disposal via road tanker. Any provisions for managing foul flows locally within the site will be designed and specified in accordance with BS EN 12566.

5 CONSTRUCTION STAGE DRAINAGE

5.1 During construction of the development, the building contractor will be responsible for management and disposal of rainwater runoff generated from the site in its temporary condition.

5.2 The contractor will implement methods to manage drainage during construction in accordance with the Code of Construction Practice (application document A8.6). These methods will address pollution management and control in relation to site plant and vehicles, raw materials storage and waste generation, to ensure that all surface water runoff generated in the temporary condition will be free of contamination.

5.3 The site will be subject to topsoil strip and bulk earthworks to prepare the site to the correct level for development. The contractor will provide temporary drainage measures as illustrated within Section 6 of CIRIA~~iria~~ C532 'Control of Pollution from Construction Sites', to contain runoff within the development site boundary, ensuring that these measures are sized appropriately, and that means to remove excess surface water are available for use at all times.

~~5.3~~5.4 It is anticipated that temporary construction compounds will be surfaced with a clean imported compacted granular fill material, laid on a geotextile separation membrane. Temporary surfaces will be laid to a crossfall for drainage purposes, with lateral surface water flows intercepted by a land drain or open channel. All surface water runoff collected during construction will require to be monitored and managed by the contractor to remove any silt or pollutants prior to discharge.

6 MAINTENANCE

6.1 The maintenance for all plot specific drainage infrastructure will be the responsibility of the owner of the proposed development. Details of the maintenance activities for the constructed drainage infrastructure will be passed to the end user as part of an Operation and Maintenance Manual post completion. Typical maintenance activities may include;

Table 3: Typical Maintenance Activities

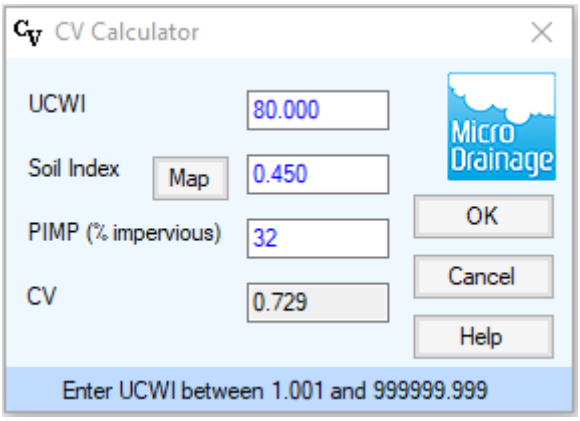
Element	Access Method	Method of Maintenance	Frequency Required
Roof Gutters	Scaffolding / Cherry pickers to be used where required.	General cleaning of gutters. Jet cleaning where required.	Periodic inspection of gutters to ensure rainwater outlets do not become blocked. Periodic renewal of gutter coatings to prevent corrosion.
Oil / Petrol Separators	In accordance with H&S regulations and confined spaces requirements.	Refer to manufacturer's guidance.	Bi-annual inspection and emptying.
Slot Drains / Kerb Drainage	In accordance with H&S regulations.	Monitor to ensure no blockages develop. Jet cleaning where required.	Bi-annual jet cleaning of channel drains.
Silt-traps and Gullies	In accordance with H&S regulations.	Monitor to ensure no blockages develop.	Bi-annual inspection and emptying of all silt traps and gullies.
Penstock Valves/ Non-Return Flap Valves	In accordance with health and safety regulations and confined spaces requirements.	Monitored to ensure no blockages develop in accordance with the manufacturers recommendations.	Bi-annual inspection or in accordance with the manufacturers recommendations, whichever occurs sooner.
Surface Water Ponds and Swales	In accordance with H&S regulations	General cleaning and monitoring to ensure no blockage. Remove litter and debris. Cut grass and manage vegetation. Inspect inlets and outlets	Bi-annual inspection, cleaning and removal of silt and/or debris
Pumps	In accordance with health and safety regulations and confined spaces requirements.	Monitored via visual and audible alarms in development gatehouse to ensure no blockages develop in accordance with the manufacturer's recommendations.	Bi-annual inspection or in accordance with the manufacturers recommendations, whichever occurs sooner.
Headwall	In accordance with health and safety regulations.	Monitored to ensure no blockages develop.	Bi-annual inspection and clearance of any debris

Appendix A – RPS Drawings

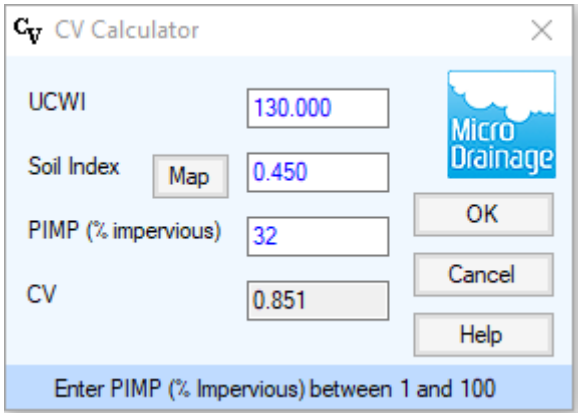
Appendix B – RPS Calculations

B.1 Runoff Coefficient Calculations

Summer CV Calculation



Winter CV Calculation



B.2 Greenfield Runoff Rate Calculation

B.3 Attenuation Basin Calculations