Project: Stage 50 (Phase 2) Wycombe Film Studios Village

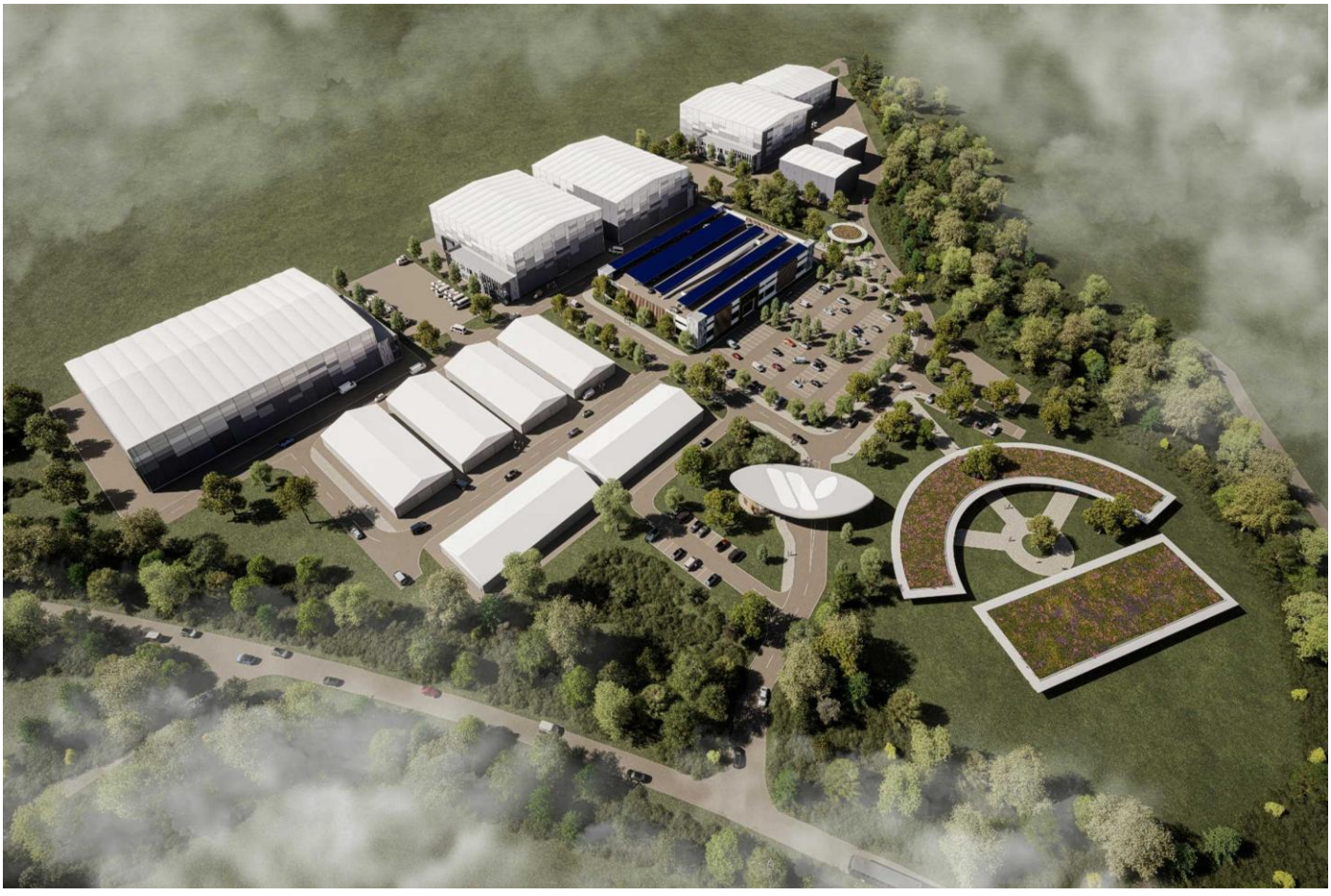
Client: Stage 50

Scope: Structural engineering design for 8 stages including foundation and superstructure and civil engineering design for the site layouts, road design and drainage design.

Project Description and Scopes:

Beta Design Consultant has completed an important, high value contract on behalf of its major client, Stage 50. Beta was involved in the second stage design of the foundation, superstructure and road design. With almost 295,000 sq. ft of high-quality production space, Wycombe Film studio offers purpose-built professional facilities. The structure design supports the studio and stages design to create unique space that support sustainable structure to use for the film production. The civil engineering design supports the client vision by delivering roadway design in the green-belt site that results in minimum impact regenerating the ex-landfill site to make it suitable for the 10-year life span of the temporary license. Overall, the design helps to create one of the UK's film industries that facilitates the art as a hub for creativity. The scope of the projects is:

- **Structural Design for Foundations and Stages**
- **Infrastructure Planning and Road Design**
- **Drainage Design**



Approach:

1. **Structural Design for Foundations and Stages:**

Software Used: Scia and Tekla Tedds

A. **Designs Checks:**

The primary scope involves design checks for the foundation for the Phase 1 stage of the Wycombe Film Studio. This includes;

-Design check of Foundations: BETA perform the structure checks for the foundation as per provided loads and design criteria. The design checks for the foundation shows that the column bases were generously sized.
-Base plate and post installed anchor bolts: The design of the base plates and the anchor bolts were based on the design forces obtained from the reference projects. Based on available data, a 600mm long by 400mm wide by 25mm thick plate have been designed with 6 M20 Hilti HIT-HY 200-A + HAS-U HCR M20 post Installed anchor.
- checks on Ground beams: Beta perform 600 x 600 Ground Beams Design Checks. Ground beams have been provided to acts as ties for the foundation, as confinements for the earth fill for the stage area and partly supports the square hollow sections (SHS) supporting the timber floor.

Recommendation:

-Due to the thickness of the foundation (1500mm), anti-shrinkage reinforcement should have been provided at the top to prevent shrinkage cracking at the top of the foundation. In lieu of this, the contractor has agreed to use fibre-reinforced concrete which is expected to limit the shrinkage of the concrete.

Figure 1 Base Plate and Stage Inspection of Wycombe Film Studio

Figure 2 Stage Frame Inspection

B. Sub-Structural Design:

After completion of first stage design check, Beta was reappointed to carry out sub-structural design for stage 2 floor of 50x60 m Wycombe Air Park Film Studios. Beta designed for;

-The structural foundation supporting the stage frames (2250mm wide reinforced concrete strip footing to support the side and corner columns; and 1700mm wide strip footing to support the gable columns).

Reinforced concrete slab – 250mm thick slab with A393 mesh fabric top and bottom.

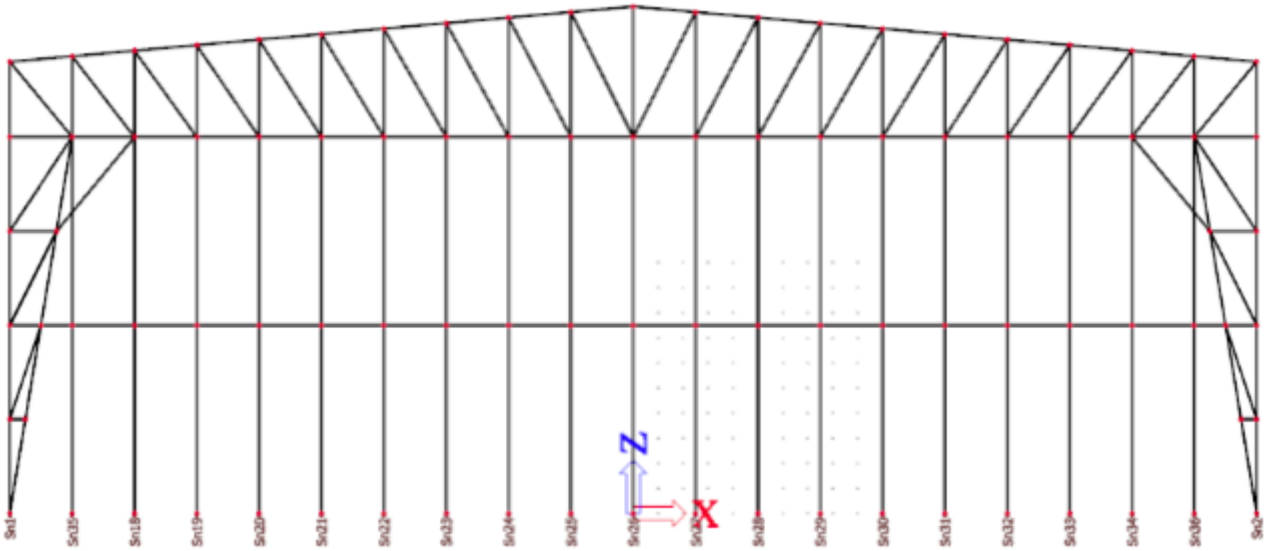


Figure 3 Gable Columns

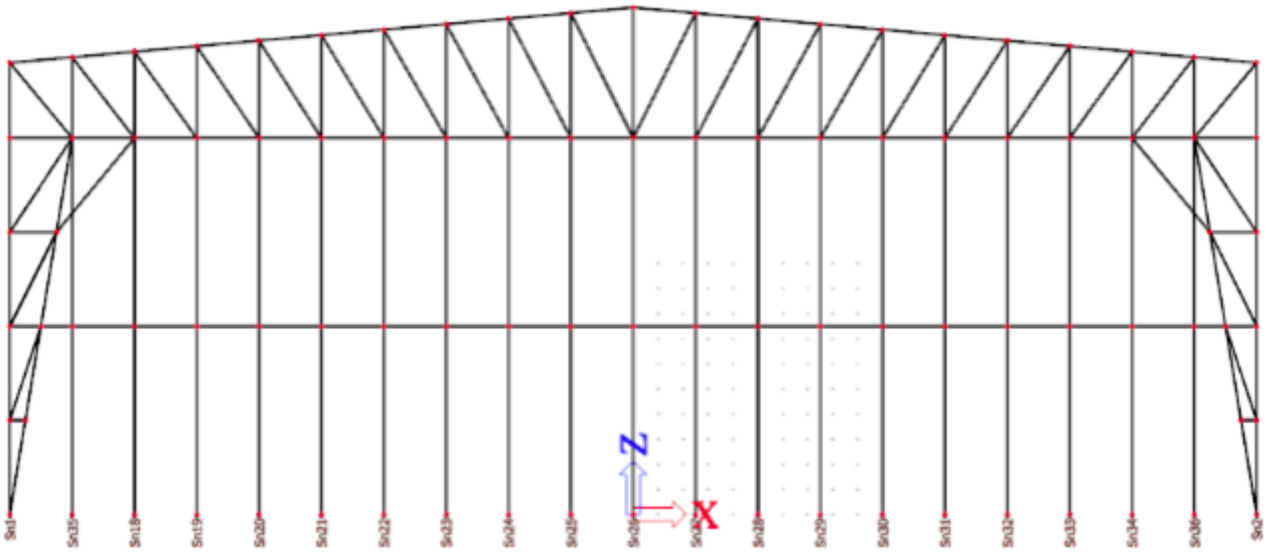


Figure 4 Side Columns

2. **Infrastructure Planning and Road Design:**

Scope: Develop a functional road network integrated with the site's drainage system and suited to challenging ground conditions.

Project Overview

Beta Design delivered a sustainable road design that addressed site-specific challenges, including a chalk layer with clay and flints and the need for stormwater management integration. The design incorporated permeable pavements, filter drains, and grading to support the Surface Water Drainage Strategy.

Challenges & Solutions

Geotechnical Conditions:

Extensive soil testing informed flexible pavement designs to ensure long-term durability on clay and flint subgrades.

Drainage Integration:

Roads featured permeable paving and filter drains to tie into attenuation tanks and basins, reducing surface water runoff.

Topography Management:

Grading optimized water flow while minimizing earthworks and avoiding poorly drained areas.

Figure 5 Working Area for Design of Wycombe Film Studio

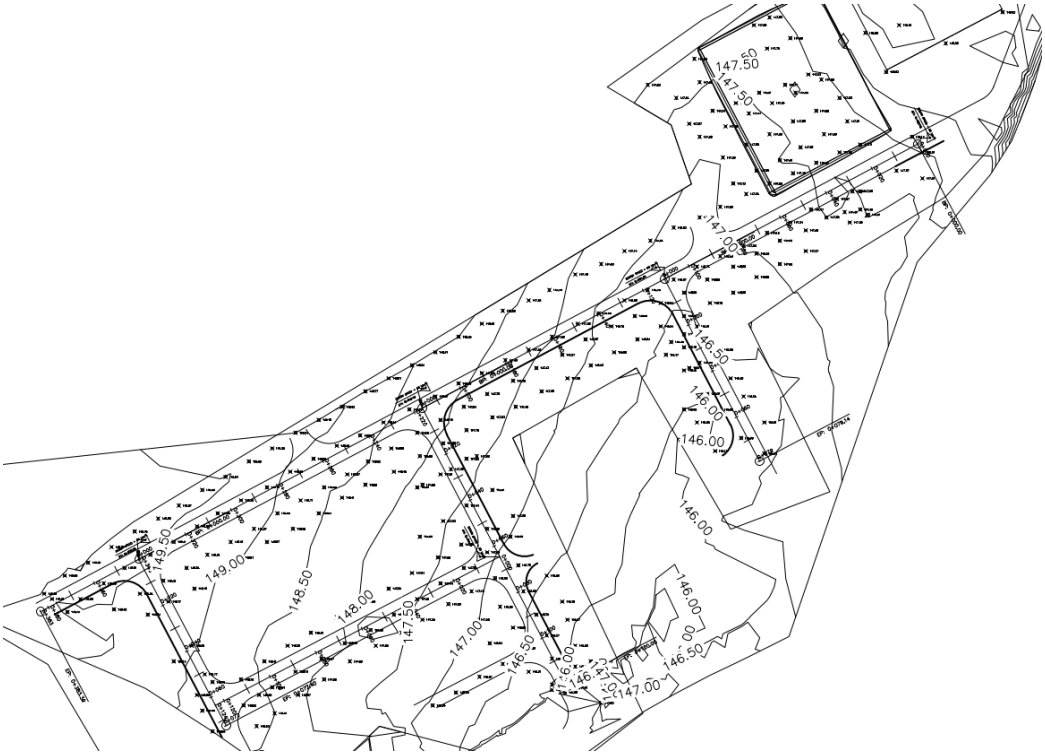


Figure 7 Top map Survey point for Phase 2 Road

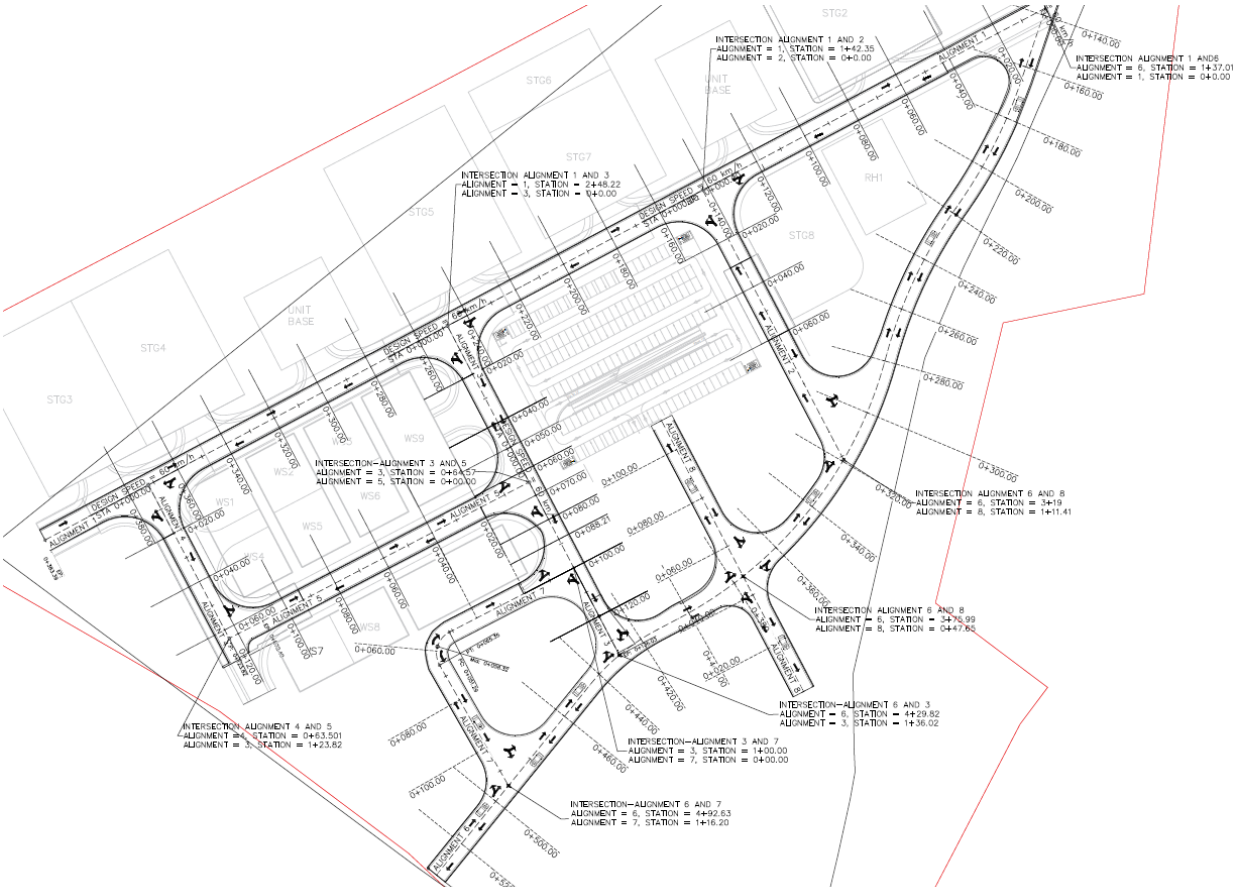


Figure 6 Detailed Road Design

Figure 8 swept path analysis for phase 2 road

3. **Drainage Design**

Scope: To create a sustainable stormwater drainage system for a development site, meeting regulatory and environmental standards.

Project Overview

Beta Design provided detailed design support for the stormwater drainage system on the project, ensuring compliance with CIRIA C753 – The SuDS Manual. The proposed Surface Water Drainage Strategy incorporated sustainable drainage solutions (SuDS), including:

Filter drains

Green roofs

Permeable paving

Attenuation tanks

Geocellular storage tanks

These features ensured the system effectively attenuated surface water for storm events up to and including the 1-in-100-year return period, plus an allowance for climate change.

Design Challenges

The site presented a unique challenge due to the presence of a chalk layer. This natural superficial deposit consisted of clay with flints, limiting infiltration and raising concerns about effective water drainage.

Approach

To address these challenges, different testing was sonducted;

Borehole and Soil Testing

Soil infiltration tests were performed at various locations to determine the site's drainage characteristics. Testing revealed variability in infiltration rates, necessitating further evaluation for soakaway compatibility.

Soakaway Feasibility Studies

Multiple soakaway tests were carried out to identify suitable locations for soakaways. Areas with the most favourable infiltration rates were prioritized in the design.

Integrated SuDS Strategy

A combination of attenuation tanks, permeable surfaces, and green infrastructure was implemented to reduce runoff volumes and improve water quality. The use of geocellular tanks provided additional storage, preventing surface water flooding.

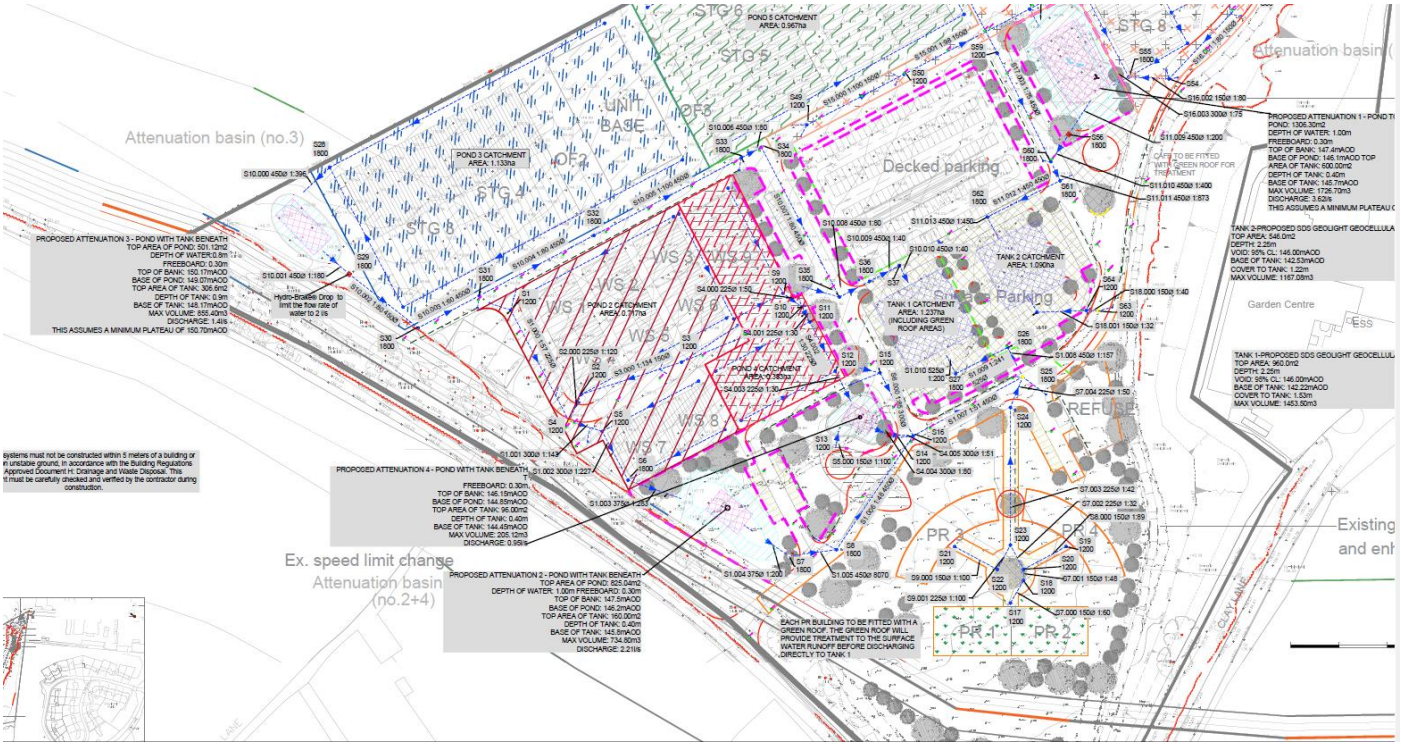


Figure 9 Drainage Strategy

Figure 10 Site Investigation Location

IMPORTANT NOTES:

1. FOR AREAS SUBJECT TO VEHICULAR TRAFFIC, SUCH AS ROADS OR CAR PARKS, THE COVER DEPTH SHOULD BE INCREASED TO AT LEAST 750MM TO 1000MM (DEPENDING ON TRAFFIC LOADS AND THE STRENGTH OF THE TANK STRUCTURE).THE CONTRACTOR MUST VERIFY SOIL CONDITIONS, EXPECTED LOADINGS, AND COVER DEPTH DURING INSTALLATION TO COMPLY WITH DESIGN SPECIFICATIONS AND RELEVANT CODES.
2. PONDS MUST BE SECURED WITH ANTI-TODDLER FENCING TO PREVENT ACCESS. WARNING SIGNS SHOULD ALSO BE INSTALLED TO ALERT AND DISCOURAGE INDIVIDUALS FROM APPROACHING THE PONDS, MITIGATING THE RISK OF DROWNING.
3. INFILTRATION SYSTEMS MUST NOT BE CONSTRUCTED WITHIN 5 M OF A BUILDING OR ROAD, OR ON UNSTABLE GROUND, IN ACCORDANCE WITH THE BUILDING REGULATIONS 2010, APPROVED DOCUMENT H: DRAINAGE AND WASTE DISPOSAL.
4. THIS REQUIREMENT MUST BE CAREFULLY CHECKED AND VERIFIED BY THE CONTRACTOR DURING CONSTRUCTION.
5. THE GEOTECHNICAL ENGINEER SHOULD ADVISE ON THE MINIMUM SAFE DISTANCE BETWEEN INFILTRATION SYSTEMS AND STRUCTURES BASED ON CHALK CHARACTERISTICS AND IDENTIFIED DISSOLUTION RISKS.
6. THE COVER LEVEL NEAR THE ROAD MUST BE CHECKED AND MAINTAINED DURING CONSTRUCTION BY THE CONTRACTOR.
7. THE COVER LEVEL NEAR THE ROAD MUST BE CHECKED AND MAINTAINED DURING CONSTRUCTION BY THE CONTRACTOR.
8. THE INFILTRATION RATE IN CHALK AREAS NEAR BUILDINGS SHOULD NOT EXCEED 10 MM/HOUR.
9. THE RISK OF FLOODING IN POND 2 IS ASSESSED AS A 1 IN 100-YEAR EVENT. TO MITIGATE THIS RISK, ANY BUILDINGS CONSTRUCTED NEAR POND 2 MUST HAVE A FINISHED FLOOR LEVEL SET ABOVE 148M AOD (ABOVE ORDNANCE DATUM) TO ENSURE PROTECTION FROM POTENTIAL FLOODING.

IMPORTANT NOTES:

1. THE CONTRACTORS NEEDS TO CHECK ALL THE DIMENSIONS ON SITE BEFORE CARRYING OUT ANY WORKS

Emergency crash gate
Keep Clear zone
Security office

PROPOSED ATTENUATION 5 - POND WITH TANK BENEATH
TOP AREA OF POND: 551.60m2
DEPTH OF WATER: 1.00m
FREEBOARD: 0.30m
TOP OF BANK: 148.66mAOD
BASE OF POND: 147.36mAOD
TOP AREA OF TANK: 270.00m2
DEPTH OF TANK: 1.20m
BASE OF TANK: 146.16mAOD
MAX VOLUME: 830.60m3
DISCHARGE: 1.5l/s
THIS ASSUMES A MINIMUM PLATEAU OF 148.60mAOD

POND 1 CATCHMENT AREA: 1.939ha

POND 5 CATCHMENT AREA: 0.967ha

POND 3 CATCHMENT AREA: 1.133ha

POND 2 CATCHMENT AREA: 0.717ha

TANK 1 CATCHMENT AREA: 1.237ha (INCLUDING GREEN ROOF AREAS)

TANK 2 CATCHMENT AREA: 1.090ha

Attenuation basin (no.1)

Attenuation basin (no.3)

Decked Parking

PROPOSED ATTENUATION 1 - POND TOP AREA OF POND: 1306.30m2
DEPTH OF WATER: 1.00m
FREEBOARD: 0.30m
TOP OF BANK: 147.4mAOD
BASE OF POND: 146.1mAOD TOP
AREA OF TANK: 600.00m2
DEPTH OF TANK: 0.40m
BASE OF TANK: 145.7mAOD
MAX VOLUME: 1726.70m3
DISCHARGE: 3.62l/s
THIS ASSUMES A MINIMUM PLATEAU OF 148.50mAOD

TANK 2-PROPOSED SDS GEOLIGHT GEOCELLULAR STORAGE
TOP AREA: 546.0m2
DEPTH: 2.25m
VOID: 95% CL: 146.00mAOD
BASE OF TANK: 142.53mAOD
COVER TO TANK: 1.22m
MAX VOLUME: 1167.08m3

TANK 1-PROPOSED SDS GEOLIGHT GEOCELLULAR STORAGE
TOP AREA: 960.0m2
DEPTH: 2.25m
VOID: 95% CL: 146.00mAOD
BASE OF TANK: 142.22mAOD
COVER TO TANK: 1.53m
MAX VOLUME: 1453.50m3

PROPOSED ATTENUATION 3 - POND WITH TANK BENEATH
TOP AREA OF POND: 501.12m2
DEPTH OF WATER:0.8m
FREEBOARD: 0.30m
TOP OF BANK: 150.17mAOD
BASE OF POND: 149.07mAOD
TOP AREA OF TANK: 306.6m2
DEPTH OF TANK: 0.9m
BASE OF TANK: 148.17mAOD
MAX VOLUME: 855.40m3
DISCHARGE: 1.4l/s
THIS ASSUMES A MINIMUM PLATEAU OF 150.70mAOD

Hydro-Brake® Drop to limit the flow rate of water to 2 l/s

Infiltration systems must not be constructed within 5 meters of a building or road, or on unstable ground, in accordance with the Building Regulations 2010, Approved Document H: Drainage and Waste Disposal. This requirement must be carefully checked and verified by the contractor during construction.

PROPOSED ATTENUATION 4 - POND WITH TANK BENEATH
FREEBOARD: 0.30m
TOP OF BANK: 146.15mAOD
BASE OF POND: 144.85mAOD
TOP AREA OF TANK: 96.00m2
DEPTH OF TANK: 0.40m
BASE OF TANK: 144.45mAOD
MAX VOLUME: 205.12m3
DISCHARGE: 0.95l/s

PROPOSED ATTENUATION 2 - POND WITH TANK BENEATH
TOP AREA OF POND: 825.04m2
DEPTH OF WATER: 1.00m FREEBOARD: 0.30m
TOP OF BANK: 147.5mAOD
BASE OF POND: 146.2mAOD
TOP AREA OF TANK: 160.00m2
DEPTH OF TANK: 0.40m
BASE OF TANK: 145.8mAOD
MAX VOLUME: 734.80m3
DISCHARGE: 2.21l/s

EACH PR BUILDING TO BE FITTED WITH A GREEN ROOF. THE GREEN ROOF WILL PROVIDE TREATMENT TO THE SURFACE WATER RUNOFF BEFORE DISCHARGING DIRECTLY TO TANK 1

Ex. speed limit change

Attenuation basin (no.2+4)

Existing tree screen and enhanced

65m

Garden Centre

BEACON LANE

DELVE LANE

Notes:

DO NOT SCALE FROM THIS DRAWING

KEY

- SITE BOUNDARY
- IMPERMEABLE AREAS
- PERMEABLE AREAS
- POND 1 CATCHMENT
- POND 2 CATCHMENT
- POND 3 CATCHMENT
- POND 4 CATCHMENT
- POND 5 CATCHMENT
- INFILTRATION TANK
- PERMEABLE PAVING
- ATTENUATION BASIN
- ATTENUATION TANK
- GREEN ROOF
- BIO-RETENTION AREA
- 10m TANK EASEMENT
- PROPOSED SWS
- PROPOSED SWS MANHOLE
- PROPOSED HYDROBRAKE
- PROPOSED CATCHPIT
- PROPOSED FILTER DRAIN

NOTES

1. ALL DIMENSION ARE IN METERS UNLESS STATED OTHERWISE
2. ALL LEVELS ARE IN METERS ABOVE ORDNANCE DATUM
3. ATTENUATION DESIGNED FOR ALL EVENTS UP TO, AND INCLUDING, THE 100YR + 40% CLIMATE CHANGE
4. LAYOUT ALIGNED WITH TEMPORARY SITE PLAN DRAWING 2667-PHASE-1-4
5. THE INFILTRATION TANK HAS BEEN LOCATED MORE THAN 20m AWAY FROM ANY BUILDING TO AVOID INITIATING CHALK DISSOLUTION FEATURES AS RECOMMENDED IN CIRIA REPORT C574
6. REFER TO DRAWING BM12040-011 FOR DETAILS OF THE SUDS ELEMENTS

REV:	DESCRIPTION:	BY:	DATE:
R01	First Issue for review	RJ	13/09/24

STATUS: For Approval

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PROJECT: Land South of Wycombe Air Park
Wycombe Film Studios
Marlow SL7 3DP

CLIENT: SCIO CAPITAL

TITLE: Drainage Strategy

SCALE AT A3:	DATE:	DRAWN:	CHECKED:
NTS	01/10/2024	RJ	FM
PROJECT NO:	DRAWING NO:		REVISION:
21-035	DWG-CI-21-035-12		R01

Results:

- Design of foundations of the stages with the roads design to reduce construction work, cut and fill and utilized sustainable practices to provide significant carbon footprint reductions. Examples included using trench foundations that removed need for shuttering and edge protection and formwork/falsework, as well as using Eco Pact RC mixes from Aggregate Industries with nearly 40% carbon savings for less than 10% increase in concrete cost.
- We integrated cutting-edge technology in ground improvement and soil stabilisation, maximizing use of laboratory trial soil-mixes, field tests and pilot trials on site to ensure the ex-landfill site is developed to support new loads. We adopted a cost-effective method for soil stabilisation and ground improvement using evidence-based soil-mix design to reduce cost and impact of civil works
- The design delivered a durable and sustainable road network that complemented the drainage strategy, reduced flood risks, and ensured compliance with relevant standards.
- A robust and resilient stormwater management system was delivered, compatible with the site's challenging geological conditions. The design achieved regulatory compliance and aligned with sustainable development principles. The strategy mitigates flood risks, while providing long-term environmental benefits, including groundwater recharge and biodiversity enhancement.