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A network of consultants in hydrology, water resources and environmental issues

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[redacted]

Ms Stephanie Eldridge
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7th February 2025
by email to:
stephanie.eldridge@westoxon.gov.uk

Dear Ms Eldridge,

Subject: Review of Wastewater Management and Related Groundwater Hydrology

24/01861/FUL Erection of a country house and gardens, stables courtyard, new highway accesses, solar array, drainage works and landscape proposals, including a new lake

Introduction

I write as WRA partner, chartered geologist and international expert in groundwater hydrology and water resources, supported by Graham Newton, chartered water and environmental manager, and expert in wastewater engineering. We act on behalf of the Little Tew Conservation Group [LTCG], which has commissioned a critical review of documentation, relating to hydrogeological and wastewater management aspects of the above-named planning application.

Documents consulted

For the purpose of writing this critique, we have reviewed the following documents:

- Price & Myers, Feb 2022: Land at Little Tew, preliminary Flood Risk Assessment.
- Colson Stone Practice, Apr 2024: Estate Masterplan
- Colson Stone Practice, Jun 2024: Drainage Strategy for Land West of Little Tew – proposed new country house, stables and landscape enhancement.
- Water Resource Associates, Sep 2024: Review of impact of proposed development at Little Tew on Little Tew Meadows SSSI
- Price & Myers, Oct 2024: Land at Little Tew, Hydrological Assessment.

Hydrogeological Setting

Elevations from north to south across the site fall from the proposed main house at 202 mOD off Banbury Road to 171 mOD on the southern boundary, which is 168 m away from the River Dorn, in the flatter valley bottom at 167 mOD. There is then over a 30 m range across the property.

Chipping Norton Limestone [g6] and Clypeus Grit [g5e] outcrop on the northern half of the site and this bedrock gives way to older Upper Lias Clay [g3] across the southern slopes. It can be expected that the upper part of the property will be permeable and lower part impermeable, although limestone generally produces a clayey slow-draining soil. Finally, a window of Marlstone Rock Bed [g2c] outcrops for a short distance of 1.85 km along the River Dorn, terminating before the end of the Little Tew Meadows [LTM] SSSI. Distribution of the geology is shown in Figure 1 and cross-section in Figure 2. This demonstrates the g6 limestone on high ground overlaying g3 clays on lower slopes, and shows how g2c penetrates through at low elevation. The geology provides an important setting for assessing drainage and wastewater management options.

Figure 1 Solid Geology of Upper Dorn, SSSI and Development Site

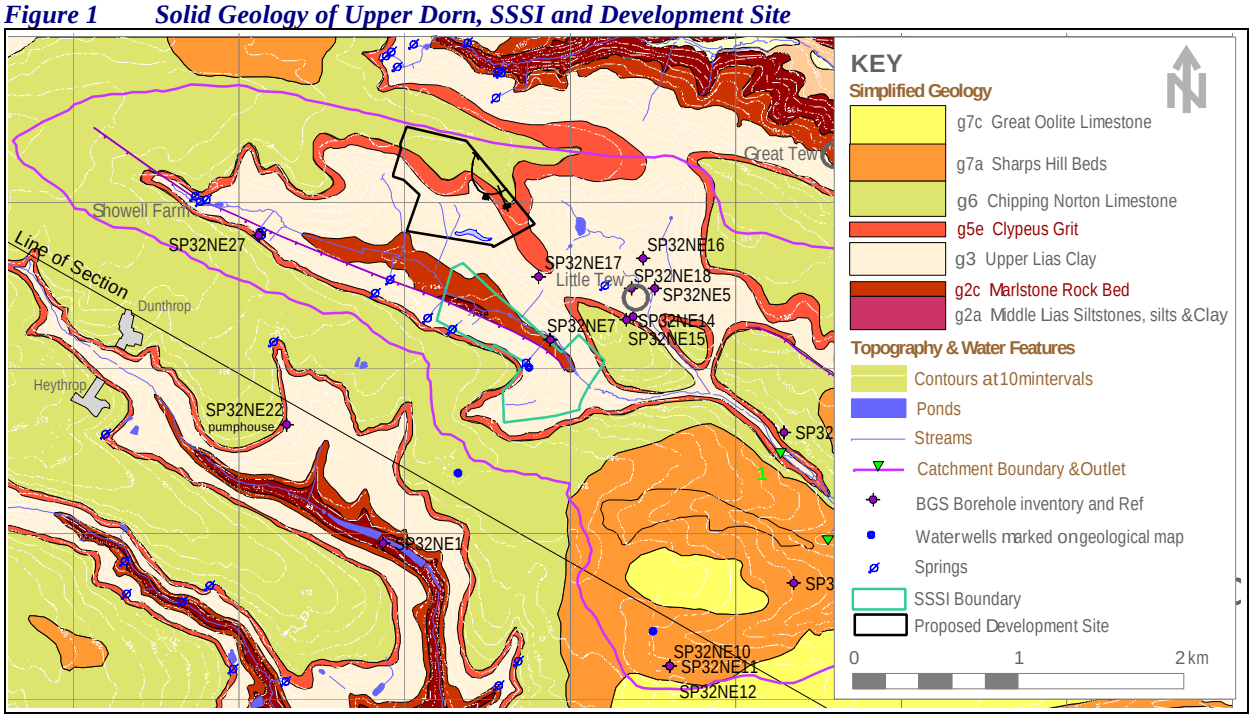
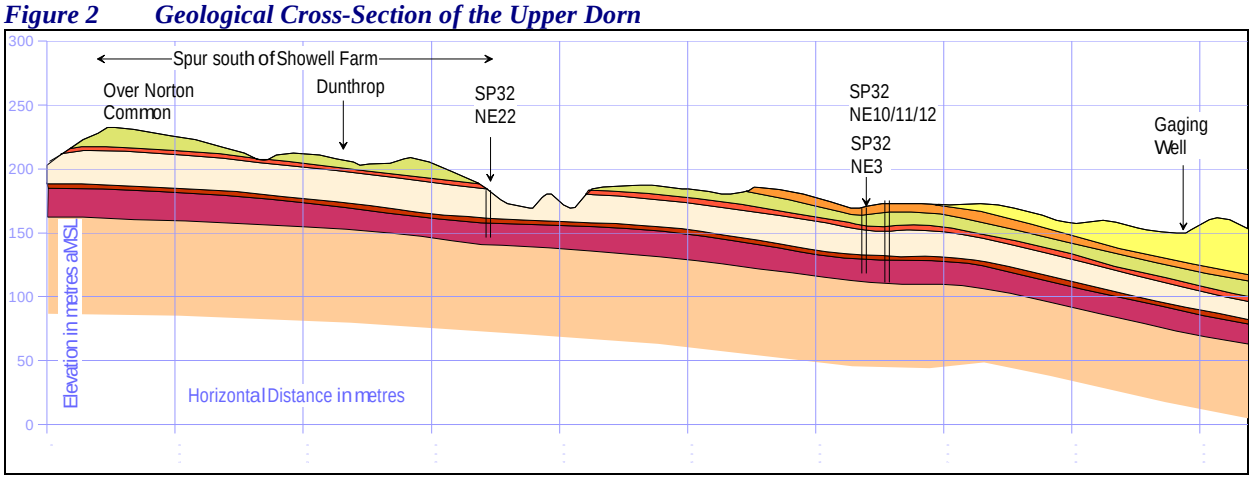


Figure 2 Geological Cross-Section of the Upper Dorn



Opportunity for Infiltration

Although the Price & Myers Hydrological Assessment report dismisses the area of proposed buildings as "*being located on impermeable Whitby Mudstone"* [Upper Lias Clay], the stable buildings would in fact be located on Clypeus Grit and the main house close to the boundary of Clypeus Grit and Whitby Mudstone. There may therefore be better opportunities to investigate use of infiltration to manage surface water runoff by infiltrating into the Clypeus Grit and/or upper horizons of the Whitby Mudstone. The position of buildings is shown in Figure 1.

The Clypeus Grit overlies unconformably the Upper Lias Clay, and provides a clear marker horizon, forming a narrow outcrop along the margins of the upland plateaux and dips south-eastwards to the valley bottoms. It attains its maximum thickness of about 7.5 m around Charlbury, but thins out to the north and east of a line joining Great Tew and Steeple Barton. The basal unit and upper part of the Lias Clay are commonly marked by seepages and local springs in the upper Dorn valley.

The Clypeus Grit is characterised by rubbly weathering, shelly, oolitic and pisolitic limestones set in a pale olive- green-tinted micrite matrix. When fresh the grains are dark grey, and the matrix paler grey. The basal part of the formation contains calcarenite pebbles and conglomeratic limestones, from which springs

frequently issue. Near Showell Farm, 880 m up-valley from the development site, the Clypeus Grit is about 1.2 m thick.

Infiltration is generally a preferred SuDS method for surface water drainage as surface attenuation systems require more maintenance, occupy the land with swales and ponds and overflow runoff will spill into the River Dorn beyond design events.

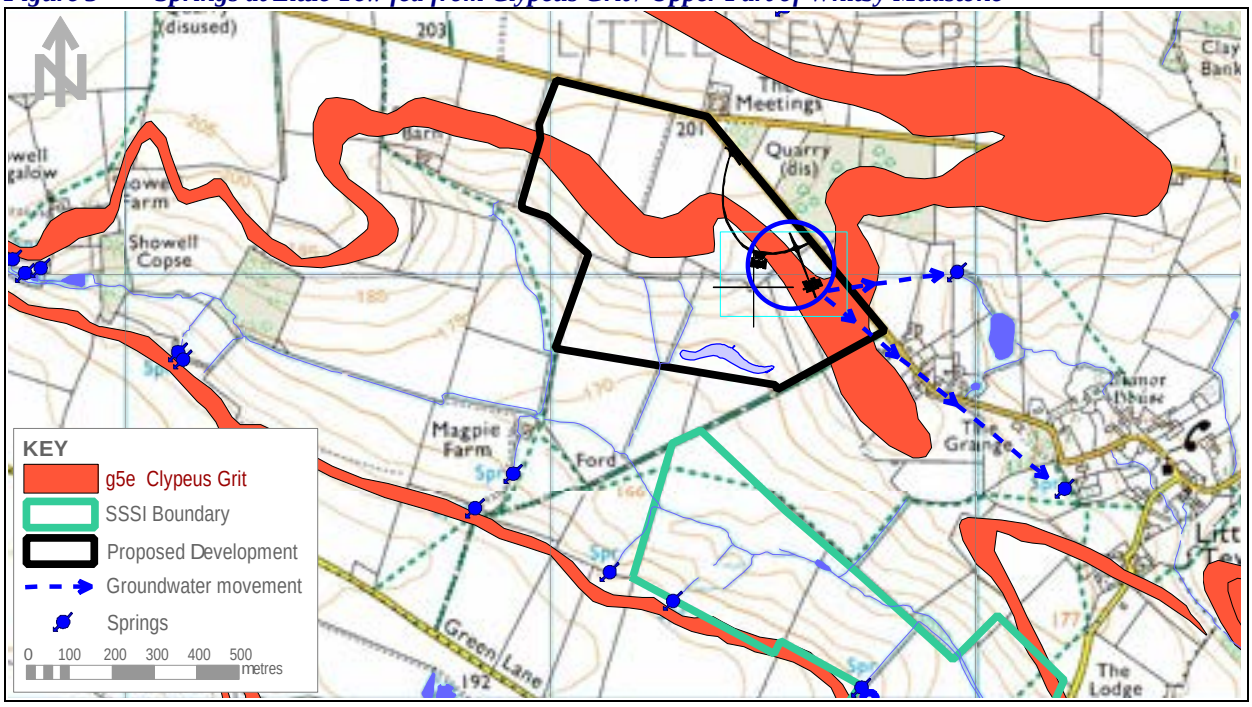
Impact on Groundwater

Price & Myers Hydrological Assessment report states the following:

"The proposed building and hardstanding areas will have negligible impact on groundwater flows, as the soils are quite impermeable at this location".

This sentence demonstrates a lack of understanding of the local geology, and the whole document is keen to dismiss contentious issues with microscopic sketches of proposed outline design. A project of this scale should have a robust ground investigation, which would provide data that can be used to demonstrate feasibility and design of drainage and wastewater systems. Figure 3 shows the positions of the project buildings relative to the Clypeus Grit and upper part of the Whitby Mudstone which are water-bearing formations and feed local springs.

Figure 3 Springs at Little Tew fed from Clypeus Grit / Upper Part of Whitby Mudstone



Wastewater Treatment

The Price & Myers Hydrological Assessment [PMHA] report states the following:

"Treated foul water from the sewage treatment system will discharge to a drainage filed [field]. *An overflow pipe will be provided to direct excess water into the pond. The pond will be large enough to dilute sufficiently the effluent before discharging into the local ditch. Refer to appendices B and C for details and the location of the treatment plant respectively.*

Livestock waste on site will be appropriately collected, stored and disposed of in line with existing requirements and obligations, including the Farming Rules for Water and the Silage, Slurry and Agricultural Fuel Oil (SSAFO) Regulations. A plan will be prepared for the management of manure and surface water runoff generated by the stable block.

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There would appear to have been at least three consultants involved in the project design, and the most recent documents refer to conflicting drainage and wastewater designs by Colson Stone and Price Myers. The two different layouts are shown in Figure 4. Both show package treatment systems and the Price Myers design shows a drainage field with overflow to the surface water attenuation pond.

There are a number of points to highlight:

Drainage fields are never designed to have overflows: they are instead intended to provide tertiary treatment by allowing treated effluent to infiltrate through the unsaturated part of an underlying aquifer, known as the vadose zone. This infiltration in aerobic conditions allows final improvement of a wastewater prior to entering local groundwater. Drainage fields should be designed to British Standard BS6297:2007+A1:2008: no design details are shown in the Price Myers report.

Design of drainage fields [also known as infiltration basins] requires data on the sub-soil and rate of infiltration, obtained through ground investigation and testing [not carried out by Price Myers].

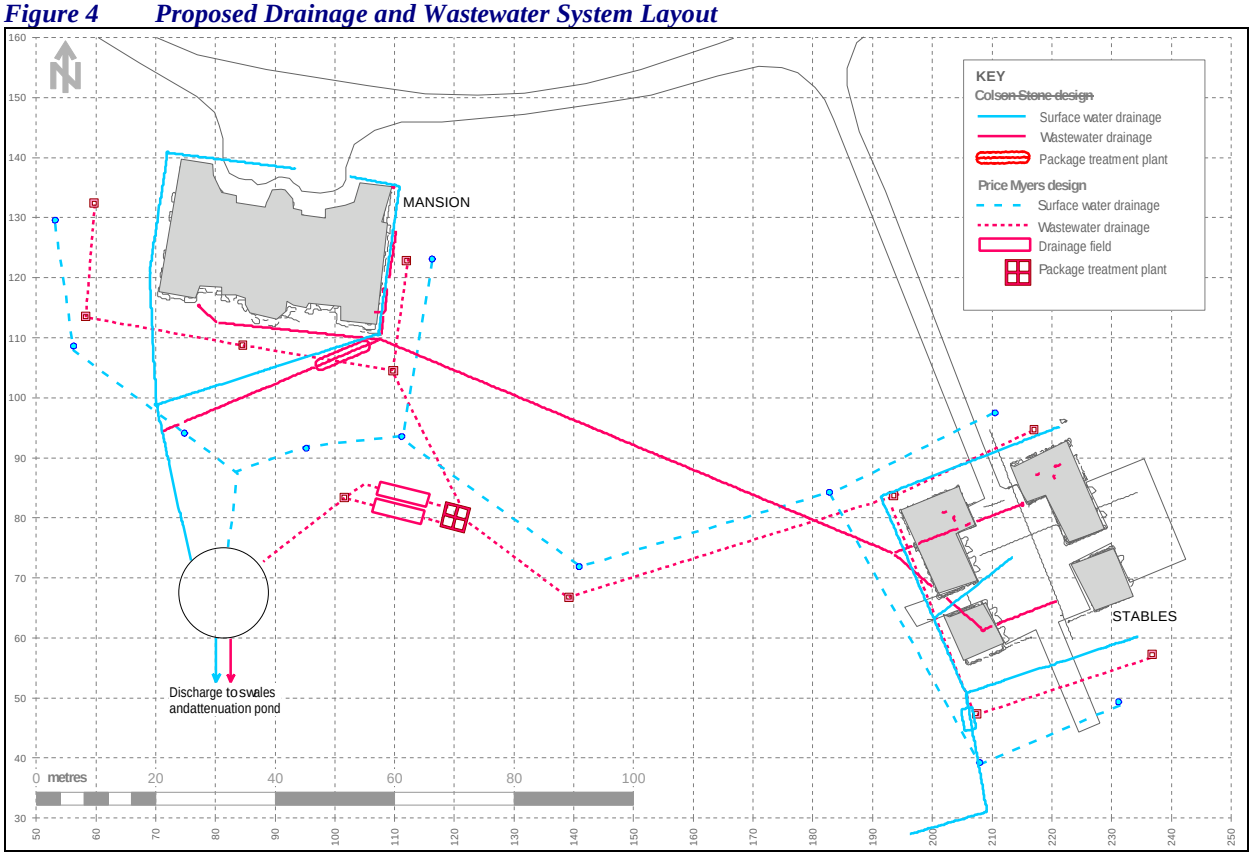
It is surprising that this form of treatment has been indicated, given the earlier incorrect comment by Price Myers that the site is located on impermeable mudstone substrate.

Consideration has not been given in the Price Myers design to the increased nutrient loading of effluent from the stables block.

Both surface water drainage and treated wastewater effluent would terminate in the proposed attenuation pond at the bottom of the property. Given that the only inflow to this pond is periodic rainfall-generated runoff, in contrast to the continuous inflow of wastewater effluent, the pond will become eutrophic during summer months, which will likely have an impact on ecological aspects of the adjacent SSSI [classified as 'unfavourable recovering]'.

Given the ephemeral nature of runoff input, the pond is unlikely to dilute the effluent during summer months before discharging into the local ditch and then the River Dorn.

Figure 4 Proposed Drainage and Wastewater System Layout



Source: Price and Myers Hydrological Assessment Appendix C [Figure SK600] and Colson Stone Drainage Strategy Appendix A

Price and Myers Hydrological Assessment Appendix B presents a contractor's proposal for bio-bubble wastewater treatment plant [Advanced Aeration Ltd]. This is for a "low nutrient effluent", not the high nutrient effluent which will be generated by proposed stables, The bio-bubble plant would not reduce phosphate to desired levels so treated effluent would be discharged to the proposed drainage field where further phosphate reduction would occur.

Although horse waste is planned to be collected and disposed off-site, even the best-maintained equestrian centres produce nutrient-laden runoff in wet weather, as stables are washed out and horses cleaned and groomed. This has not been considered in the design parameters.

The proposed wastewater treatment plant would require an environmental permit to discharge treated effluent to groundwater and also a consent to discharge the overflow to local surface water, both issued by the Environment Agency. The Price and Myers report does not mention the existence or granting of a permit: if no permit exists, it is not normal to design a plant without first obtaining one.

If an environmental permit is granted, the conditions imposed then determine the specification of the plant. The currently proposed treatment may not be the most effective option. There are better treatment systems available other than the proposed Bio Bubble. For example, Marsh Industries claims to be the first company in the UK to achieve the stringent phosphate reduction targets set by Natural England and the Environment Agency. They claim a reduction to below 0.28 mg/l against the Bio Bubble <5.00 mg/l.

Table 1 Bio-Bubble Final Effluent Quality [95 percentile]

Water Quality Parameter	Concentration	Unit
Biological Oxygen Demand (BOD5)	5.0	mg/l
Suspended Solids	15.0	mg/l
Ammoniacal Nitrogen (NH4-N)	<1.0	mg/l
Total Nitrogen ~ Annual Average	<5.5	mg/l
Total Phosphate ~ Annual Average	< 5.0	g/l

< This should probably read mg/l

Source: Advanced Aeration Ltd [Price and Myers Hydrological Assessment Appendix B]

Other considerations are reliability, ease of operation, guarantees and costs. Advanced Aeration Ltd only guarantee their plant for operation without failure for one year.

The proposed treatment produces a dense flocculation sludge with reduction to form 80-90% compost and required solids removal at intervals of 3 to 4 years. The foul water management plan indicates that sludge would be removed from the treatment plant and spread on land allocated within the property. This plan is not sensible, and contradicts the General Binding Rules for Small Sewage Discharges [2015] which requires that only a company which is a registered waste carrier may dispose of waste sludge [Rule12].

Furthermore, the proposed development cannot meet the General Binding Rules if the new discharge is within 500m of a SSSI boundary, special protection areas, or special areas of conservation. The point of final effluent discharge from the treatment system would be located 360 m from the boundary of Little Tew Meadows SSSI, in which case an exception permit (Rule 18) would be required. As runoff through the proposed swales would be ephemeral, the weir at the attenuation pond outlet may be considered to be the final point of discharge, which is even closer at 195 m.

The planning application documents should include permit pre-applications for sewage treatment plant discharge, in order to demonstrate whether an exception would likely be granted.

Finally, there is the potential case of overflow into the River Dorn when the treatment system fails or there are accidents in handling sludge. Entry of nutrients or pathogens into the river would potentially affect private water well supplies downstream, which have a rapid-flow connection to the river through fissures in the Chipping Norton limestone. An example is the well at Tracey Cottage.

Conclusions

1. Contrary to Price Myers dismissal of local geology, opportunities may exist to use infiltration for management of surface water runoff by infiltrating into the Clypeus Grit and/or upper horizons of the Whitby Mudstone, confirmed by position of local springs in the upper Dorn valley.
2. Infiltration is generally a preferred SuDS method for surface water drainage as surface attenuation systems require more maintenance, occupy the land with swales and ponds and overflow runoff will spill into the River Dorn beyond design events.
3. Price Myers dismissal of impact on groundwater given local evidence of springs from Clypeus Grit and Whitby Mudstone: Proposed mansion and stables would be situated on the Clypeus Grit and upper part of the Whitby Mudstone which are water-bearing formations and feed local springs
4. A project of this scale should have a robust ground investigation, which would provide data that can be used to demonstrate feasibility and design of drainage and wastewater systems.
5. Three consultants were involved in the project, present conflicting drainage and wastewater designs, which incorporate package treatment systems and a drainage field with overflow to the surface water attenuation pond.
6. Drainage fields [infiltration basins] are not designed to have overflows: no design details are shown requiring data on groundwater level and infiltration rate, obtained through ground investigation. This option contradicts Price Myers assertion that the site is located on impermeable mudstone substrate.
7. Consideration has not been given in design presented to the increased nutrient loading of effluent from the stables block.
8. pond will become eutrophic during summer months, which will likely have an impact on adjacent SSSI.
9. Proposed treatment is for a low nutrient effluent, not proposed stables. The bio-bubble would not reduce phosphate to desired levels, only 5.00 mg/l. compared to usual below 0.28 mg/l.
10. The proposed wastewater treatment plant and drainage field would require an environmental permit to discharge treated effluent to groundwater, subject to hydrogeological risk assessment, not provided and a consent to discharge the overflow to local surface water, both issued by the Environment Agency.
11. Reliability, ease of operation, would be dependent on regular maintenance: Advanced Aeration Ltd only guarantee their plant for operation without failure for one year.
12. The proposed treatment discharge and foul water management plan would not satisfy General Binding Rules for Small Sewage Discharges [2015], relating to sludge discharge and proximity to a SSSI boundary.
13. The planning application documents should include permit pre-applications for sewage treatment plant discharge to demonstrate whether an exception would likely be granted.
14. Overflow of nutrients and pathogens into the River Dorn would potentially affect private water well supplies downstream, which are connected to the river via fissures in the Chipping Norton limestone.

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