Report to: **Environment Committee, 27th October 2020**

Report of: **Corporate Director - Homes and Communities**

Subject: **ASTWOOD CEMETERY – DRAINAGE OPTIONS REPORT**

1. Recommendation

That the Committee:

1.1 Notes the professional advice provided to the council in respect of this matter, and the views of family representatives, in relation to options for drainage works within the Muslim Burial Area at Astwood Cemetery;

1.2 Recommends Full Council to make capital and revenue budget provision for both the drainage improvement works, and the memorial garden works outlined at Section 7.1 of this report, and

1.3 Authorises the Director of Homes and Communities to procure the works necessary to implement both the drainage improvement works, and the memorial garden works.

2. Background

2.1 Astwood Cemetery and Crematorium is an historic burial site serving the City of Worcester and its environs. The cemetery occupies 28 Ha and is located 2 km north east of Worcester City Centre. It occupies the gently sloping valley sides of the Barbourne Brook which runs in a north westerly direction through the centre of the site, and is surrounded by roads, residential properties, a secondary school and allotments.

2.2 The cemetery was laid out in 1858 in response to the city's former burial ground at Tallow Hill becoming full and the current crematorium and chapel were added in the 1960s. The site has some 50,000 graves and accommodates in the region of 2,000 cremations and 90 burials annually.

2.3 During mid-2018 an issue of water ingress was identified in section 38, this being the designated Muslim Burial Site, which had been in use since 2001. Those family representatives with loved ones in the area were notified and a range of surveys have been undertaken to assess the suitability of the area for further burials and to consider the options to alleviate poor drainage.

2.4 This report provides the options for consideration in relation to the mitigation of drainage issues, along with a proposal to develop the area immediately surrounding the graves into a fitting memorial garden.

3. Information

3.1 A detailed analysis has been carried out in line with Environment Agency guidance, to determine current data relating to drainage, water levels and future use of this area of the Cemetery as a result of the drainage survey commissioned in 2019.

3.2 In 2019 it was deemed that due to such a high-water table being experienced across the area of the site in question, that it was appropriate to prevent further burials from taking place. Following further investigation works which are outlined in this report, it is not the intention of the Council to use this area for future burials and instead to utilise part of the area for a fitting memorial tribute and part for above ground memorialisation moving forward ensuring these 2 uses are complimentary in nature.

3.3 As a result the Council commissioned Jacobs who are an internationally recognised technical professional consultant to investigate the matter further with a view -

- Providing a local drainage solution to protect existing graves against any further water ingress;
- Dewatering of the area in and around the existing graves that does not disturb the burials, and
- Providing an assessment on the suitability of the remaining unused area of the existing location for below ground burials having regard to water table

3.4 Jacobs have confirmed that ground conditions at this location of the site were unforeseen without the extensive level of investigation that has been carried out in respect of this matter. The investigation has confirmed that poor drainage is being caused by an aquifer that is situated in this area of the site, which feeds a layer of permeable mudstone strata causing it to be saturated. On top of the mudstone is a layer of low permeability clay weathered bedrock, upon which sits a layer of low permeable clay soils which in some areas at this location are significantly shallow. It is when these upper layers of low permeable layers are disturbed or removed (when the mudstone which is under pressure), when groundwater can rise above ground surface.

3.5 Jacobs have developed an options appraisal undertaken in general accordance with Environment Agency guidance to identify the best practical technique for groundwater control to mitigate water ingress to this section of the site, and if necessary, undertake dewatering works.

3.5 Five options were identified to mitigate the water ingress to the graves in this area, which are provided below:

i) Borehole dewatering from a single borehole anticipated to a depth of 10m installed in proximity to the burials.

ii) Deep land drainage from a rectangular drainage trench of approximate dimensions of 13 x 11m installed to the top of the bedrock surrounding the existing burials. Pipework would be lain in the trench and fall to a sump that would require pumping.

iii) Deep cut-off wall comprising an impermeable grout curtain, installed by rotary techniques, into impermeable bedrock, cutting off water inflow to the permeable horizons beneath the burial horizons giving rise to groundwater ingress.

iv) Shallow bentonite / cement slurry cut-off wall of approximate dimensions 13 x 11m, nominally 600mm wide and keyed into bedrock.

v) Shallow concrete cut off wall: of approximate dimensions 13 x 11m nominally 600mm wide and keyed into bedrock.

3.6 The expert advice has outlined the key benefits and disadvantages of each option and these are attached at **Appendix 1**, and the families affected by this issue have had the opportunity to consider the options relating to mitigation of the drainage issues, and have informed council officers that their preference would be the implementation of option (i) above – this being Borehole Dewatering.

3.7 It is proposed that the immediate area surrounding the graves be developed into an appropriately designed memorial garden, for and with the families who have loved ones buried in this area as a fitting tribute. This would involve budget provision in the region of £25,000, that will include the appointment of a landscape specialist to work with the families and the development and delivery of an appropriate scheme with associated signage to the new area for Muslim burials.

4. Preferred Option

4.1 Option (i) is the preferred option as this is recommended by the consultant as having the greatest potential impact on drainage and is also the preferred option identified by family representatives.

4.2 The expert advice indicates that option (i) could take up to 12 months to complete and through regular consultation with families the council would look to commence procuring a contractor to undertake these works as soon as is practically possible.

5 Alternative Options Considered

5.1 The option to do nothing is not recommended by officers, as there is a need to address the drainage issues in this area.

5.2 Having regard to the expert advice the four other options listed are not recommended as they are not considered as effective in mitigating impact of drainage issues in this area.

6 Next Steps

6.1 Subject to approval of this report and a subsequent report to be considered by Council for provision of funding, further investigation works will be undertaken which will clarify the final design of the works and will also clarify what regulatory approvals will be required before works can commence.

6.2 Further work will also be progressed to develop the proposed Memorial Garden through the appointment of a landscape designer, and consultation with the families affected.

6.3 Operational procedures will be developed to embed the safe working procedures required for this dewatering process to be undertaken on the site.

6.4 The Chair and Vice Chair of the Environment Committee will be kept up to date through regular briefing with progress on the areas of work outlined above.

6.5 Communication will be continued with family representatives throughout this process.

7 Implications

7.1 Financial and Budgetary Implications

The capital and revenue costs of each option are summarised in the table below. The preferred option has a capital cost of £55,000 which can be incorporated into the capital programme. If funded entirely from borrowing, this would give rise to an annual revenue pressure of approximately £2,200 based on a 25-year asset life.

Groundwater Control Option		**Estimated Cost**	**£k (excluding VAT)**		
		Initial Capital Cost (£k)	**Maintenance / Operation over 25 Yrs**	**Optional Monitoring**	**Total Cost 25 Yrs(£k)**
1	Borehole Dewatering	55	20	15	90
2	Deep Land Drainage	50	20	12	82
3	Deep Cut-off Wall	71	-	9	80
4	Shallow Bentonite / Cement Slurry Cut-off Wall	13.5 - 26	-	9	22.5 - 35
5	Shallow Concrete Cut-off Wall	18	-	9	27

Revenue costs will also need to be built into future years budgets and if subject to approvals, option (i) is implemented, would amount to £3,250 per year (£8,250 for first 3 years taking into account monitoring costs), including borrowing costs.

Budget provision of £25,000 is also required to design and develop the proposed memorial garden and it is considered prudent to identify this as budget in the interests efficiency and timeliness rather than have to formally request this of Committee at a future date.

Therefore, based on both elements of work spanning a 25 year period, the capital element required is £80,000 with the revenue element required being £35,000.

7.2 Legal and Governance Implications

There are no legal or governance implications in respect of this report.

7.3 Risk Implications

Subject to approval, the implementation of the proposed scheme of works provides the best opportunity of mitigating drainage issues. It should be noted however that these works cannot provide an absolute guarantee of no further issues.

It should also be noted that option (i) is also subject to the granting of any regulatory approvals that the scheme of works may require. All endeavours will be made to seek necessary approvals.

7.4 Corporate/Policy Implications

There are no corporate/policy implications in respect of this report.

7.5 Equality Implications

The council will continue to engage with and consult with family representatives and community representatives to ensure their views and any religious or cultural beliefs inform the planning, preparation and undertaking of works, subject to approval.

7.6 Human Resources Implications

There are no human resource implications in respect of this report.

7.7 Health and Safety Implications

All options recommended by the consultants are compliant with relevant health & safety requirements. Subject to approval measures will be put in place to ensure that any impact on the wider site will be mitigated.

7.8 Social, Environmental and Economic Implications

Subject to approval, the undertaking of works will improve environmental conditions at this section of the site, but also it is hoped bring comfort and a level of closure to families. This is an important site for the Muslim Community of the City and the council in consultation with families, will want to provide a lasting and fitting memorial once the works have been completed.

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Background Papers:	**Jacobs Report – Astwood Cemetery Groundwater Control Options**

Appendix 1 – Shortlisted Groundwater Control Options, Advantages & Disadvantages

Groundwater Control Options		Principal Advantages	Principal Disadvantages
Capable of protecting existing graves against further ingress by relieving artesian and sub-artesian pressure			
1	Borehole Dewatering	• Can be constructed in proximity to existing graves/ and minimise disturbance when compared to installation of a trench • Single well can efficiently remove water from a small area • Potential to use solar pumps • Works in a wide range of aquifer conditions • Could enable further burials	• Likely to require permanent pumping and discharge point • Unknown discharge rate for a given drawdown and will be variable and subject to recharge • Constraints on point of discharge, regulatory requirements, ecological constraints and consents • Discharge will need to be located outside of cone of groundwater depression to prevent re-circulation • Potential to abstract water that is polluted • WCC liability for any pollution incident, ongoing maintenance, and licensing requirements
2	Deep land drainage	• Construction is normally simple and rapid • By controlling groundwater close to the base of weathered bedrock, groundwater volumes could be minimised • Whole life costs may be less than for other systems • Potential to use solar powered pumps	• Competent bedrock and groundwater levels may impede construction • Performance depends on properties of materials in which they are constructed, may be localised • Adjacent materials may become blinded through ingress of silt and so may require ongoing maintenance • Likely to require permanent pumping and discharge point • Unknown discharge rate will be variable and subject to recharge • Constraints on points of discharge, regulatory requirements, ecological constraints • Potential to abstract groundwater that is polluted • WCC liability for any pollution incident, ongoing maintenance, and licensing requirements
3	Deep cut-off wall	• Temporary pumping • No regulatory requirements	• Extensive equipment required for installation • Difficult to treat / install in competent bedrock, comparatively thick zone might need to be treated • Little control over grout with the potential to ingress int grave space • Potential for walls to degrade over time
Capable of stopping throughflow			
4	Shallow bentonite/cement slurry cut-off wall	• Easy to install • Maintenance Free • No pumping required • No regulatory requirements	• Unlikely to offer protection to the existing graves from artesian and sub-artesian pressure • Concrete may be subject to cracking
5	Shallow concrete cut-off wall		