US Army Corps of Engineers ®

New England District, Engineering Division
696 Virginia Road
Concord, Massachusetts 01742-2751

REVIEW COMMENTS

Project Name: Former Uniroyal-Facemate Property Filling Project	**Date**: 1 July 2021
Location: Chicopee, MA	**Reviewers**: Kevin DiRocco/ Patrick Blumeris
USACE ICW Project: Chicopee Riv LB - Chicopee Falls, MA	
Documents Reviewed: (1) Letter prepared by BETA Group, titled Former Uniroyal-Facement Property Filling Project, Response to USACE Comments, dated May 20, 2021 (2) Letter prepared by O'Reilly, Talbot & Okun Associates for BETA Group, titled Chicopee Levee Slope Stability – Response to USACE Comments, Uniroyal Filling Project, dated May 12, 2021.	
Submitted By: BETA Group	Submittal Dated: May 20, 2021

No.	Reference (June 2021)	COMMENTS	BETA/OTO MAY 2021 RESPONSE	USACE REVIEW JUNE 2021
1.	General	Provide a site-specific conversion from NAVD88 to NGVD29 for direct comparison to the original design plans.	A note has been added to Figure 3 provided a conversion factor between NAVD88 and NGVD29 elevations.	Note added – **Comment is closed**.
2.	General	The City needs to be aware and acknowledge that if the Oak Street Pumping Station is abandoned as planned, they will need to retain the physical property in perpetuity, unless the pump station is deauthorized by Congress. Also, the City well need to retain the property rights for the full width of the levee embankment.	Comment noted. This information has been conveyed to the City.	As part of the formal 408 submittal package, provided a written acknowledgement from the City that they will retain the physical property in perpetuity.
3.	Doc. No. 1	Will the proposed infiltration basin and drain in the former Facemate property increase flow to the Main Street Pumping Station? If so, has the capacity of the pump station been evaluated to ensure that it can pass the additional flow? Provide verification that the proposed stormwater management system will pass the original design precipitation and that flows to the Main Street Pumping Station will not increase.	A HydroCAD model has been provided with the Stormwater Management Report, showing a net decrease in peak discharge rate from the property to the Main St. Pump Station. The model for the Facemate Property has been revised such that the predevelopment conditions utilize rainfall rates from Technical Paper 40 in accordance with the original design calculations. Post-Development models have been modified to utilize greater rainfall rates, NOAA Atlas 14, to reflect modern-day increase in rainfall intensity.	The proposed change does increase the permeable area, reducing surface water runoff, even with the more recent Atlas 14 rainfall intensity. **Comment is closed**.
4.	Doc. No. 2	The current proposal is to leave the landside grade approximately 3 feet below the crest of the levee embankment at both properties to act infiltration basins. The infiltration basins will be provided with a perforated HDPE drainage pipe surrounded by a crushed stone drainage layer and geotexitle. This is different from the previous concept drawings where filling was proposed to the landside crest of the levee embankment. This proposed configuration will potentially result in landside water loading that must be accounted for in the geotechnical evaluation.	The revised stormwater management design has been provided to the Geotechnical Engineer and incorporated into the geotechnical evaluation. Refer to letter entitled "Chicopee Levee Slope Stability – Response to USACE Comments" dated May 12, 2021 and prepared by O'Reilly, Talbot, & Okun Associates (OTO).	Refer to OTO responses to comments 17 through 19. **Comment is closed**.
5.	Doc. No. 1	There is no discussion in the report or drawings about abandonment of the 4x4 concrete box discharge culvert from the Oak Street Pumping Station to the river. Because the conduit penetrates the levee embankment, it should be fully grouted or filled with concrete or flowable fill to prevent collapse and settlement of the remaining embankment. While collapse of the conduit does not appear to significantly increase the risk of flooding in the leveed area, filling of the conduit is required for this portion of the project to remain active in the PL84-99 Rehabilitation Program.	A detail is provided on Figure 11 describing the methodology of abandoning the Oak St. Pump Station Discharge Structure. The requirements have been revised per the recommendations of this comment.	The final 408 submittal needs to include the filling procedures and specifications for review and approval.
6.	Doc. No. 1	How will the stormwater in the Uniroyal property infiltration pond be managed when the Oak Street Pumping Station is taken off line and the HDPE drain piping has not yet been extended to the South Outfall? Is there a temporary condition of potentially significant water loading on the landside of the levee embankment that needs to be considered in the geotechnical evaluation?	Figures 12 and 13 have been added to the Planset, describing the sequence of construction in greater detail. Phasing will include backfilling as much of the Site as possible prior to decommissioning of the Pump Station. During Phase 6, a swale will be constructed to redirect flow around the pump station and towards the southern outfall. The Contractor shall be required to establish interim dewatering measures.	The added figures are a useful addition. **Comment is closed**.

US Army Corps of Engineers ®

New England District, Engineering Division
696 Virginia Road
Concord, Massachusetts 01742-2751

No.	Reference (June 2021)	COMMENTS	BETA/OTO MAY 2021 RESPONSE	USACE REVIEW JUNE 2021
7.	Doc. No. 1	The proposed design, especially for the Uniroyal property relies heavily on infiltration, especially when the river is elevated. We have the following comments: o Has an evaluation been performed to demonstrate that the infiltration rates will be adequate to handle the inflow and that storage within the soil will be sufficient to capture all of the inflow during design storms? Provide the analysis and assumptions that demonstrate the infiltration demand will be met. o The materials management plan provided to us suggests that a wide-range of materials will be accepted at the site, with the primary acceptance criteria being type and level of contamination. Compacted materials used for fill may have a lower than anticipated hydraulic conductivity. What requirements will be placed on the materials accepted to ensure sufficient infiltration rate and storage capacity?	The proposed fill management design is conceptually illustrated on Figure 8. Per this design, the top 3' of fill, including beneath the proposed basins, will be clean soil rather than the fill materials accepted elsewhere on the Site. The proposed basins include a perforated HDPE underdrain which will capture infiltrated stormwater before it reaches the deeper fill materials. A note has been added to the infiltration basin detail on Figure 9 describing the acceptable soils to be used for the basin subbase. The soil mixture, including silt and clay composition, has been determined based on the USDA Nation Soil Survey Handbook to reflect a sandy loam, loamy sand, or sand. According to Volume 3, Chapter 1, Page 22 of the Massachusetts Stormwater Handbook, this type of soil has a minimum infiltration rate of 1.02 inches/hour. This exfiltration rate has been incorporated into the HydroCAD model to show that the basins will drain at an adequate rate. During construction, the soil subbase will be evaluated to confirm infiltration capacity. Note that all basins are provided with a low-elevation catch basin. These drain inlets are the primary source of drawdown, rather than relying on infiltration.	The model includes the 1.02 inches per hour "exfiltration" rate. The orifice coefficient 0.6 at the typical catch-basin might have been bigger, but the selection appears to be reasonable. Given the spacing of the catch basins, the design appears to adequately augment the expected soil infiltration rate. The contract specifications shall provide specific requirements for soil grain size testing and exfiltration rate testing to ensure that material provided meets or exceeds the minimum requirements.
8.	Doc. No. 1	In the Existing Conditions Description (page 3 of the report, page 12 of the 88-page pdf), there was an unfinished thought in the paragraph that followed the listed bullets - "an underground toe drain that groundwater." Was the intent to say "an underground toe drain that *connects* to groundwater?"	This sentence was intended to say "an underground toe drain that collects groundwater." It has been corrected in the revised report.	The changes have been made as indicated. **Comment is closed**.
9.	Doc. No. 1	In the explanations for the Ten Standards, Page 9, Standard 9 ends with "will be in accordance with the attached Operations and Maintenance Plan." Should this statement read "… with a *Regulator-approved* version of the attached Operations and Maintenance Plan?"	The narrative has been revised to indicate that the Long Term Operation and Maintenance Plan will be Regulator-Approved.	The changes have been made as indicated. **Comment is closed**.
10.	Doc. No. 1	The models provided for the existing layout include a lot of concrete pipe, with an assumed Manning n=0.011 (range for concrete is 0.011 to 0.015). The modeled assumption is that the new pipe will be PVC, with Manning n= 0.010 (this is typical for glass, but is unlikely to remain so small if it is PVC, subject to wear and tear over many years). The levee system is intend to have a very long design life, and we assume that the drainage system will be designed for a long life as well. Based on our experience, the assumed n values are optimistic for long term conditions. While the assumed n values fall within the ranges stated in references (for example, HEC RAS), we recommend that the models also be evaluated with a Manning n value at the middle to upper end of the range for each material. For example using n=0.012 or higher for PVC and n=0.013 or higher for concrete pipe.	The design calculations have been revised to use the requested mannings n values. Pipe slopes and inverts have been modified accordingly.	The changes have been made as indicated. **Comment is closed**.

No.	Reference (June 2021)	COMMENTS	BETA/OTO MAY 2021 RESPONSE	USACE REVIEW JUNE 2021
11.	Doc. No. 1	On Page 73 of the report, there is a runoff volume of 0.5 inch that is used to estimate a required storage volume. It was not clear how that 0.5 inch was derived (24-hour precipitation values for the location ranged from 2.5 inches for a 1-year event to 6.50 inches for a 100-year event). The 0.5-inch appears to be based on a shorter duration, or else most of the storm event is being "lost" as seepage to groundwater, which is not true for these largely impervious areas (percentage impervious in excess of 85%). The delta-t in the model is typically 0.05 hours (3 minutes), but the delta-t was once quoted in the computer output as this value, divided by 2. The number may be correct, but a couple of lines of explanation seem to be needed, to include a depth-area-duration statement along the lines of "the XX inch flow requirement is based on the most intense TTT minutes of the RTP-year storm, and assumes that PP% of the storm rainfall needs to be conveyed." This statement may need to precede or follow the computer outputs.	The required storage, or "Water Quality" volume, has been designed in accordance with the Massachusetts Stormwater Handbook, Standard 4. This volume reflects a quantity of runoff from which a sufficient concentration of TSS must be removed. The water quality volume for the proposed BMP design was calculated as the volume of runoff stored in the basins beneath the rim elevation of each proposed catch basin. Stormwater stored in this area will infiltrate into the ground, rather than flow into the catch basins, to provide capture of sediment. The storage volume for the full extent of the proposed basins has been determined via the HydroCAD models, using the 100- year, 24-hour storm event over a 72-hour timespan. The narrative has been revised to clarify the source of the 0.5-inch parameter.	Storms under Atlas 14 and TP-40 are of similar size, although the current precipitations in Atlas 14 are larger than the older TP-40. There are developments in the basin that did not occur as the designers anticipated, so the runoff is smaller than the designers planned. The design allows for ponding of six inches, amounting to the required 0.5 inches of storage from the internal basin. This is independent of the storm intensity (so long as the storm runoff volume exceeds 0.5 inches). The pipe roughness modifications have led to pipes being raised to a condition of flowing closer to capacity, with smaller margins before the 100-year flow is reached, but the 100-year flow is conveyed. **Comment is closed**.
12.	Doc. No. 1	Velocity checks for half-full or completely full pipes: The calculations should yield identical velocities with double the flow in the full pipe, but that doesn't appear to be what is presented. For a headloss equation – such as the Manning equation – in a circular pipe, the ratio of half-full area to half-full wetted perimeter is the same as the ratio of the full area to full wetted perimeter. Since the other parameters in the Manning equation do not change for a given pipe, only one of the velocity estimates stated is correct. For the case that was checked, the velocity in the pipe flowing full appeared correct and the half-full pipe was nevertheless found to be greater 2 fps (but should have been 4.24 fps). The design result is acceptable for self-cleansing, but this could lead to early scouring of the pipe wall as well as materials reaching their destination (pumps, possibly) earlier than anticipated by the designer (can the pumps cope with this flow?) Please review these calculations and their context.	The calculation sheets have been corrected to accurately calculate the wetted perimeter and half-full area.	The full and half-full flow capacities are reported, based on the new assumptions for the pipe roughness. The full-pipe velocities are presented. Since $V_{full} = V_{1/2\ full}$, the issue disappears, and $V_{1/2\ full}$ has not been reported. The new capacity flow estimates are close to, but bigger than, the estimated 100-year peak flows. All computed flow velocities demonstrated potential for self-cleansing, although there was one case for which the 2-fps velocity might only be reached about every 5 to 10 years. The drawings submitted do indicate that the actual slopes should be determined from starting and ending elevations, to be fine-tuned in the field. Where a 100-year design velocity as at or just below a self-cleansing 2 fps, the detailed design will need review to ensure that this velocity is achieved in the field. The 100-year velocity, flowing full, is also achieved flowing half-full, but even this flow corresponds to roughly a 5-year storm. This is a self-cleansing velocity. If self-cleansing occurs so infrequently, it will be necessary to ensure that there is a program to flush these lines on occasion. **The levee system O&M Manual shall be updated to include routine inspection of the pipes and cleaning as required.**

No.	Reference (June 2021)	COMMENTS	BETA/OTO MAY 2021 RESPONSE	USACE REVIEW JUNE 2021
13.	Doc. No. 1	On Page 77 of the technical pdf report there is reference to TSS removal. It was not clear how the 25% rate was obtained.	TSS Removal rates are based on Volume 1, Chapter 1, Page 11 of the Massachusetts Stormwater Handbook. The narrative has been revised to clarify the source of this information.	The reference to the Massachusetts Stormwater Handbook has been made. USACE has confirmed the source and duplicated the calculation for percent TSS removal. As stated, the proposal complies to the maximum extent practicable, although it does not achieve 80% removal of post-construction TSS. This is deemed adequate, given that, post-construction, the site is not expected to generate significant industrial waste. **Comment is closed**.
14.	Doc. No. 1	The drawings indicate that the existing to drain pipes and the drain lines within the footprint of the backfill are to be "abandoned" in place. Please explain what is meant by abandoned. For example, will they be filled, capped and left empty, or other method.	Existing drainage structures, except those to be adjusted and re-used, will be backfilled in place and sealed with grout plugs and left empty. Existing drainage lines will not be backfilled, but the connections to abandoned drainage structures will be capped with grout.	Clarify what is meant by drainage structures will be backfilled in place. We assume that this applies to manhole and catch basin structures. How will these structures be filled?
15.	Doc. No. 1	Based on a review of the original as-built drawings, aerial imagery from Google Earth, and inspection photos, it's not clear if some regrading has already been done on the original high ground between Sta. 36+00 and Sta. 37+00 (between former Uniroyal and Facemate properties). Are there plans to grade this area as well as filling the two areas shown on the plans provided? If so, what are the details? What will the finished grade be in this area relative to the top of the existing levee embankment?	The high ground between the Uniroyal and Facemate properties is not proposed to be re-graded under this submittal. A portion of this associate parcel that is graded towards the Uniroyal property will be backfilled, but drainage patterns will not be modified (Refer to Figure 6). Existing survey data indicates that grades in this area range from 104' to 110', compared to the levee elevation of 100' – 101'. An existing drain inlet at the western side of the parcel captures runoff and conveys it to the Chicopee River through a nearby outfall. No modifications are proposed to this drainage system.	**Comment is closed**.
16.	Doc. No. 1	It appears that a new ramp will be constructed at the northern end of the Facemate property. Design and construction details will be required for the new ramp. In addition, we have the following questions: ○ The existing toe drain passes through the proposed ramp area. Will the toe drain still be required? Will the ramp be permeable with a filter between the embankment and the ramp to allow drainage? ○ Will the ramp affect the short and long term global stability of the levee toward the river? Need an engineering evaluation.	The plans have been revised such that this ramp is no longer proposed due to avoid alterations to the levee. Vehicular access to the top of the levee will continue to be provided through other access points elsewhere from the landward side of the levee.	Closed

No.	Reference (June 2021)	COMMENTS	BETA/OTO MAY 2021 RESPONSE	USACE REVIEW JUNE 2021
17.	Doc. No. 2	The stability report indicates that the rapid drawdown analyses were performed using the USACE 3-Stage Method. However, only drained strengths are provided in the report, which only applies to the first stage of the analysis. Provide the undrained strengths and final strength envelope used for the second and third stages of the analysis.	Refer to OTA letter dated May 12, 2021	The parameters used for developing the strength envelopes for the second and third stages of the rapid drawdown analyses were not provided. Refer to Appendix G of EM1110-2-1902. However, we concur with the conclusion that the landward filling is not likely to decrease the safety factor for rapid drawdown. The filling will raise the elevation of the normal groundwater level landward of the levee, and the elevated groundwater could be a concern if impervious fill materials were saturated under proposed conditions that were not saturated under existing conditions. This would increase the likelihood of the impervious materials becoming saturated during a flood event. However, based on a review of the as-built levee embankment, the gravel fill zone on the riverside toe of the embankment within the Uniroyal fill area is expected to act as a drain, preventing saturation of the impervious fill near the riverside face of the embankment. Within the Facemate fill area, the perforated HDPE pipe can be expected to act as a toe drain, lowering the landside groundwater level. **Provide filter calculations for the selected non-woven geotextile to be used around the crushed stone surrounding the perforated HDPE pipes and provide specifications for the envelope of material around the geotextile to ensure that the geotextile will not clog.**

No.	Reference (June 2021)	COMMENTS	BETA/OTO MAY 2021 RESPONSE	USACE REVIEW JUNE 2021
18.	Doc. No. 2	The stability analyses show the landside groundwater during rapid drawdown will be at or close to the normal level in the granular fill shown beneath and landward of the levee embankment. Seepage analyses are not provided, and it is not clear if the analysis for determining the landside groundwater level included the benefit of the toe drain or assumed that the granular fill provided drainage. It seems likely that the analysis considered the toe drains given the reliance on the BEC analyses and recommendation to provide a landside blanket drain connected to the toe drain. The current fill plan calls for abandonment of the toe drain, so the analysis needs to assume that the toe drain does not exist. Also, it is not clear if the analyses considered the following: ○ The current plan for the site filling, does not include the blanket drain on the landside slope of the embankment recommended in the original stability report. ○ The gradation of the "crushed fill" placed landward of the levee embankment is likely to be highly variable and the permeability is unknown. This fill is unlikely to be free draining may retain water during a rapid drawdown scenario in the river. ○ The gravel fill shown in the Sta. 41+00 cross section may not extend the full width of the fill area landward of the existing levee embankment and the former building walls likely penetrate the gravel fill, forming a seepage block. Also, according to DM-2, the levee embankment downstream of Sta. 35+00 was constructed within the former river channel, and as a result, the gravel fill in this area may have been placed within the original river channel to increase the size of the Uniroyal property. As a result, the lateral extent of the gravel fill landward of the levee may be limited. The crushed fill could have a significantly lower permeability than the gravel fill, forming a low permeability cap, and increasing the steady-state seepage pressures in the gravel fill.	Refer to OTA letter dated May 12, 2021	**Concur. Comment is closed.**
19.	Doc. No. 2	The current plan calls for construction of infiltration basins immediately landward of the levee embankment. The Stormwater Management Report suggests that the proposed infiltration basin will be filled with water during an extreme event. For the stability analyses, the landside groundwater level for both cross sections evaluated should either be assumed to be at or near the top of the levee embankment, to reflect the maximum estimated water level in the infiltration basin during the design storm event, or a seepage analysis or other evaluation is required to justify a lower anticipated phreatic surface in the embankment and landside fill prior to rapid drawdown.	Refer to OTA letter dated May 12, 2021	**Concur. Comment is closed.**
20.	Doc. No. 2			The decommissioning of the Oak Street Pump Station discharge structure shown on Figure 11 calls for removal of the "south headwall." We understand that this note refers to the headwall on the riverside slope of the embankment. However, the figure does not explain what is to be done with the conduit that extends from the gate structure to the river. At a minimum, we recommend that the conduit be capped with a concrete bulkhead. However, we recommend that the City consider completely filling the conduit between the intake structure with flowable fill or concrete to ensure that the conduit will not collapse in the future, creating a maintenance issue in an area of difficult access and in an area where repair will require environmental permitting.

US Army Corps of Engineers ®

New England District, Engineering Division
696 Virginia Road
Concord, Massachusetts 01742-2751

No.	Reference (June 2021)	COMMENTS	BETA/OTO MAY 2021 RESPONSE	USACE REVIEW JUNE 2021
21.	Doc. No. 2			Stability analysis cross sections show that a bulk of the embankment is constructed from impervious fill. However, the large impervious fill zone shown in the analysis cross sections is not consistent with the as-built drawings, which show most of the zone identified as impervious fill in the analysis cross sections was constructed from random fill. Based on the contract specifications, the material and compaction requirements were different for both materials. We understand that the analysis cross sections were based on analyses performed by GZA for levee accreditation. However, levee accreditation analyses are submitted to FEMA without USACE review and approval. We reviewed the levee accreditation documents provided to us for the record, and we did not find justification for combining the impervious fill and random fill into a single unit for analysis. Please provide supporting documentation to show that the impervious fill and random fill properties are similar and that combining of the random fill and impervious fill zones is appropriate. The supporting information should provide justification for both the strength and permeability assumptions.
22.	Doc. No. 2			Provide justification for the normal landside groundwater level for the Case 1 and Case 5 stability analyses for the Sta. 13+30 and Sta. 41+00 stability analyses, respectively. We anticipate that the proposed filling and existing drainage system removal will result in a significant rise in the normal groundwater level landward of the embankment. Also, the embankment cutoff trench and embankment riverside impervious fill blanket will reduce the potential for groundwater to flow toward the river.
23.	General			As part of any Section 408 approval, we will require that the levee system O&M Manual be updated to reflect the changed conditions and the any new operation and maintenance requirements and procedures. The proposed interior drainage system represents a significant alteration to the project and is integral to performance of the levee system after the project is completed. The final Section 408 submittal shall include the O&M requirements for the new interior drainage system to ensure long term performance. At a minimum, USACE will require routine video inspection of the HDPE drainage piping and all connected piping to the point of discharge and visual or video inspection of all associated catch basins drainage manholes.