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TECHNICAL MEMORANDUM TO PRESENT AND EVALUATE STORMWATER DETENTION ALTERNATIVES AT THE HERBICIDE ORANGE STORAGE AREA SITE 8A NCBC GULFPORT MS

11/1/2002

TETRA TECH

TECHNICAL MEMORANDUM

Date: 1 November 2002

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RE: Evaluation of Site 8A Stormwater Detention
Remedial Design
Site 8 – Herbicide Orange Storage Area
Naval Construction Battalion Center
Gulfport, Mississippi

The purpose of this technical memorandum is to present and evaluate stormwater detention alternatives at the Herbicide Orange Storage Area (Site 8A), Naval Construction Battalion Center (NCBC) in Gulfport, Mississippi. Additional and/or improved stormwater detention features will likely be required at Site 8A to address increased stormwater drainage from Site 8A due to grading and surface finish changes resulting directly from the remedial action.

The following paragraphs describe the procedure used to determine stormwater run-off, discusses the Mississippi requirements for implementing permanent stormwater detention features, and describes alternative stormwater detention features.

Stormwater Run-off Determination

Pre- and post-construction stormwater run-off calculations are performed to determine whether changes made to watershed conditions will increase the surface water flow from the watershed to downstream areas. The pre-construction run-off calculation models existing watershed conditions and calculates an existing rate of run-off for a selected storm event. The post-construction run-off calculation models the proposed watershed conditions and calculates the expected rate of run-off for a selected storm event. These results are compared to determine if there is an expected increase in stormwater run-off with proposed watershed conditions. In the event that an increase in stormwater run-off is expected, detention features may be required to reduce potential flooding of downstream areas. The amount of increased run-off that requires the installation of stormwater detention features is typically defined by the state. However, local counties or communities may establish these requirements. Several different calculations or models can be used to calculate the amount of surface water run-off from an identified watershed (SCS Unit Hydrology or TR-55 method, Santa Barbara Unit Hydrology Method, Modified Rational Method, etc.).

Regardless as to which method is selected, the model inputs are similar. Each method utilizes a factor that describes surface type (i.e., grassy, wooded, or paved land), time of concentration (time required for water to flow from furthest upgradient point in evaluation area), area of watershed, and storm intensity (the amount of rain expected with a determined storm frequency). The model selected to calculate the pre- and post-construction run-off flows for this project is the SCS Unit Hydrology or TR-55 method. With this method, surface type is described using a curve number (CN) and the time of concentration is described using a Tc factor.

Mississippi Regulations

Surface water discharge from Site 8A and associated drainage channels discharges at NCBC Outfall 3. From this discharge point, surface water that discharges from NCBC flows into the Gulfport, MS surface water drainage system. Based on a review of the Master Drainage Plan for the City of Gulfport, MS (December 1998), it appears that the surface water drainage system for the City of Gulfport is at or near capacity. Therefore it is assumed that any increases in stormwater discharge related to changes made to a watershed must be controlled using stormwater detention features prior to the point of compliance. In other words, post-construction run-off must be the same or less than the pre-construction run-off at the point of compliance. In accordance with the Mississippi Storm Water Pollution Prevention Plan Guidance Manual, the point of compliance is a location where stormwater run-off exits the watershed, property, or developed area. For this remedial process NCBC Outfall 3 will be considered the point of compliance.

Existing and Proposed Watershed Conditions

The watershed to be evaluated for this project consists of Site 8A, which is approximately 13 acres, and the drainage channels that collect run-off from Site 8A. The point of compliance for this project will be NCBC Outfall 3 located along 28th Street. The existing conditions of Site 8A are natural conditions consisting of wild vegetation with sparse trees and piles of soil ash. An estimated CN factor of 70 represents existing site conditions. The post-construction conditions of Site 8A include a concrete pad over the 13-acre site. An estimated CN of 98 represents proposed site conditions. The change from pre-construction to post-construction conditions represents an increase in the CN factor. In addition, the change in surface type from natural soils that are cement stabilized to concrete will decrease the time of concentration. The combination of increasing the CN and decreasing the time of concentration over a 13 acre area will result in a substantial increase in stormwater run-off from Site 8A. Therefore, it is anticipated that a stormwater detention feature or a combination of features will be required downstream of Site 8A to avoid increasing the peak discharge at NCBC Outfall 3. Preliminary calculations were performed to determine pre- and post-construction run-off. The pre-construction run-off was determined to be approximately 40 cubic feet per second (cfs), and the post-construction peak run-off was determined to be approximately 120 cfs. This represents an increase in the peak run-off of 80 cfs. Using the TR-55 storage curves yields a required storage area of approximately 4.2 acre ft, or 182,952 cubic feet. When evaluating a stormwater detention process consideration must be given to the cumulative size requirement of the device or devices. It should be noted that the post-construction conditions have not yet been determined, and the pre-construction conditions have been estimated for the purposes of this technical memorandum. Once the post-construction grading plan is selected, a more detailed

calculation will be performed to determine both pre- and post-construction run-off conditions.

The remaining areas that will undergo remediation include the on-base drainage channels that feed NCBC Outfall 3 and the off-base wetland area. The off-base wetland areas are to be returned to pre-construction conditions (slopes and surface type). Therefore, no increase in run-off from these areas will occur as a result of the remedial action. Alterations that may be made to the drainage channels that feed NCBC Outfall 3 will only increase the efficiency of the channels thus reducing/delaying the peak flow from the channels. No pre- and post-construction run-off calculations have been or will be performed for these areas.

Stormwater Detention Features

Due to the size of the proposed concrete pad, it is anticipated that a stormwater collection system will be needed to convey stormwater from the concrete pad to the drainage channels. The following is a description of alternative stormwater detention features that could be used along with the stormwater conveyance system to store the expected increase in stormwater run-off from Site 8A.

Increasing Channel Capacity: This stormwater detention alternative requires widening and/or deepening the existing drainage channels that convey flow from Site 8A to NCBC Outfall 3. Increasing channel size increases the allowed flow area which slows the velocity of flow, increases the storage capacity of the channel, and increases the time required for water to flow from the channel inlet to the channel outlet. Increasing the depth of channels increases the channel's storage capacity creating a detention pond effect in the channel, storing stormwater prior to discharge. An optional method to increasing channel capacity through excavation includes the construction of berms or weirs across the width of the channels. This would create a series of detention ponds that will increase the storage capacity of the channels, retain flow, and lesson/delay the peak run-off flow rate.

Underground Storage Tanks: This stormwater detention alternative includes installing large pipes or tanks below the proposed concrete pad. The tanks would collect the run-off from the concrete pad and store the water below the pad. Acting much like a detention pond, the tank outlet structure would release an increasing amount of flow as the depth of water within the tank increases. An alternative to installing the tank system below the concrete pad would be to install the tanks adjacent to the concrete pad. The detention tanks would store stormwater run-off, and lessen/delay the peak run-off flow rate.

Stormwater Detention Pond/Basin: This stormwater detention alternative includes the construction of a large pond adjacent to the proposed concrete pad of Site 8A. The pond would be designed to contain the run-off from the concrete pad and an outlet structure would be designed to release surface water run-off at varying discharge rates (e.g. discharge from pond would increase as water level in the pond increases). The detention pond/basin would store stormwater run-off and lessen/delay the peak run-off flow. An option to having a detention pond adjacent to the concrete pad would be to have the detention pond placed on a portion of the concrete pad. Under this alternative approach to constructing an adjacent detention pond, a portion of the concrete pad

could be sloped in a manner that directs surface water on the concrete pad to collect in low areas on the concrete pad. Outlet structures could then be placed with increasing capacity in this area to control the amount of flow discharged from the concrete pad.

Advantages and Disadvantages

The following paragraphs discuss the advantages and disadvantages of each of the alternatives described above.

Increasing Channel Capacity: Sediment will be removed from the drainage channels that surround Site 8A and the channels used to convey flow from Site 8A to NCBC Outfall 3 as part of the remedial action. Therefore an advantage to increasing the channel capacity is that this alternative is already part of the remedial action. Additionally, increasing the cross-section of the channel would provide more storage with the least amount of additional land being disturbed. Also, by implementing incremental weirs along the length of the drainage channels, even more stormwater run-off storage could be realized in the drainage channels. However, the installation of berms with weirs increases the amount of required maintenance to keep the individual outlet structures functioning properly.

Underground Storage Tanks: The advantage to this alternative is that stormwater run-off is stored/detained on-site. In addition, because a stormwater collection system will likely be required due to the size of the concrete pad, an underground tank detention system below the concrete pad or a tank detention system adjacent to the concrete pad would not be difficult to incorporate. However, because the tank and pipe features occupy valuable storage space for stabilized contaminated sediments and will need to be constructed to allow for gravity flow to the drainage channels, the elevation of the concrete pad would be increased to allow for the installation of the storage system. Additionally, due to the loads resulting from the concrete pad and equipment, and because the tank system would need to be installed within a consolidation area of contaminated sediments, use of specialized materials for the tanks and collection system may be required.

Stormwater Detention Pond/Basin: Advantages to using a stormwater detention pond/basin include the ability to construct a stormwater detention feature adjacent to the site that will require little maintenance. In addition, the pond/basin can be designed to allow for future increases in stormwater run-off associated with future NCBC development. However because of the elevations of the proposed concrete pad and surrounding area, in order to achieve expected storage volume requirement, the detention pond/basin will need to cover a large area since the depth of such a feature will be limited. If consideration is given to creating a detention pond/basin within the concrete pad area, the depth of ponding water should be considered.

Conclusion

With the remediation of the drainage channels (removal of contaminated sediments), the capacity for stormwater run-off storage will increase within the drainage channels. However, to achieve a storage capacity of approximately 4.2 acre ft, consideration must be given to installing supplemental detention features. It is recommended that the remainder of the required storage volume be made up by constructing a detention

pond/basin in the vicinity of the proposed Site 8A concrete pad. In the event that the construction of a detention pond/basin is not practical, it is recommended that a combination of on-site sloping, underground storage piping (surface water collection system), and increased channel capacity be used to contain the increased stormwater run-off expected from the Site 8A concrete pad.

For the off-base swampland area and drainage channels that feed NCBC Outfall 3, following remedial actions, the areas will be returned to pre-construction conditions. Therefore, stormwater detention features are not required for these areas.