Drainage Relief Pond
Alternative Analysis

Pond Need and Purpose:

There is a local need within the City of Shenandoah to remove large areas of permanent standing water and to provide positive drainage relief out of the City. Currently, there is a significant permanent drainage backup along Carter Slough Tributary One that extends west and upstream from the east city limit boundary (at the Union Pacific Railroad), across IH-45, and into the Vision Park Regional Detention Pond. This drainage backup is primarily due to the local topography that does not allow positive drainage towards the east across the Union Pacific. There is also localized flooding that occurs with floodwaters frequently overtopping David Memorial Drive, Ed English Drive, and Shenandoah Park Drive causing road closures.

The Applicant is proposing a drainage relief pond in the City of Shenandoah, Montgomery County, Texas just west of the city limit boundary. The pond is designed to hydraulically disconnect the ponding areas within the city limits from the ponding areas downstream of the city limits by excavating out a large pond and constructing a pump station. The pond is designed to lower the permanent water surface levels, provide a path for positive drainage, and give the City more control over floodplain mitigation. However, the City also wants to retain, if not improve, the existing natural aesthetics and recreation potential associated with the existing open water. To do this, the pond will need to be landscaped and constructed with a wet-bottom amenity.

The Preferred Alternative for the proposed Project consists of excavating a large pond and constructing a pump station.

Project Siting Criteria

The City of Shenandoah is interested in developing the project within the City of Shenandoah boundaries to provide drainage relief for the citizens and visitors of the City. A search for other properties within the City of Shenandoah was conducted before deciding on the Preferred Alternative. The City of Shenandoah searched for alternative properties to accommodate the purpose and need of the project that met the following siting criteria:

1. The site had to be located on undeveloped land within the City of Shenandoah on land already owned by the City or on land which could be acquired by the City;
2. The site had to have sufficient area to be able to either provide approximately 284 ac-ft worth of storm water storage on top of any existing storage that the site may already be providing which results in measuring at least 20 acres in size; and
3. The site had to adequately provide positive drainage inside the City limits that would eliminate permanent standing water upstream from the most easterly portion of the City near the Union Pacific Railroad along Carter Slough Tributary One;

It is important to note that the design solution had to adequately mitigate any increase in peak flow rates due to the removal of the existing natural storage, and be design accepted by the governing jurisdictions of any downstream channel or river that is accepting the increased peak flows.

Alternatives:

The City of Shenandoah considered the following alternatives to evaluate whether they meet the overall purpose and need of the proposed project: a No Action Alternative, two Onsite Alternatives, three Offsite Alternatives, and the Preferred Alternative. A brief description of each alternative is provided below.

No Action

Though the no action alternative would avoid all impacts to Waters of the U.S., it would not meet the need and purpose of the proposed project. As the undeveloped areas within the watershed continue to be developed, the inevitable increase in runoff volume will only increase the level of permanent standing water in the City. Neighboring developers and jurisdictions (Montgomery County and TxDOT) understand the issue with the lack of positive drainage to and through Carter Slough. However, no assistance has been offered in fixing the issue. Therefore, the no action alternative is not practicable for the City.

Design Alternatives

In addition to the preferred detention pond solution, five other design options were initially explored. These included (1) constructing several large culverts under the Union Pacific railroad and a large earthen channel from the city limit line east to the West Fork of the San Jacinto River, (2) constructing a large reinforced concrete box that would route runoff from the city limit line to the Montgomery County MUD 95 drainage channel which ultimately drain into the San Jacinto River, (3) a detention pond located on a 44-acre parcel located to the north of the Sam Moon development, (4) a detention pond on a 30-acre undeveloped area located within MUD 95 east of the railroad, and (5) a combination detention pond utilizing the existing TxDOT detention pond (9-acres) and the City's Vision Park Detention pond (10-acres).

Reproductions of the National Wetlands Inventory (NWI) maps were reviewed (attached at the back of this analysis) and illustrate potential wetlands and waters on the alternative sites. Wetland analysis based on estimates using data from the NWI provide the following acreages for each offsite alternative. These numbers have not been ground-truthed.

Alt 1 – forested/shrub wetland, 11.2-acres.

Alt 2 – emergent wetland, 3.3-acres; forested/shrub wetland, 4.6-acres.

Alt 3 –forested/shrub wetland, 32.3-acres.

Alt 4 – forested/shrub wetland, 6.9-acres.

Alt 5 – emergent wetland, 2.6-acres' freshwater pond, 0.04-acres; riverine, 0.6-acres.

The Design Solution Alternatives are included in **Attachment A. Table 1**, below, is a summary of the selection criteria used to select the preferred design alternative.

Table 1: Design Alternative Comparison Matrix

Practicability Category	Factor	Preferred Alternative (Pumped Pond)	Alt. 1 (City Channel)	Alt. 2 (MUD 95 Channel)	Alt. 3 (Pond at 44-acre Site)	Alt. 4 (Pond at MUD 95)	Alt. 5 (TxDOT and Vision Park Ponds)
		Yes	No	Yes	No	No	Yes
Available	Owned by City or Available for Acquisition	City owns the parcel.	Channel outside City Limits and ETJ. Land not for sale.	Possible land acquisition opportunity available	Land not for sale and outside of the City ETJ	Land reserved for wetlands mitigation and green space. Outside of the City ETJ.	Vision Park pond is owned by the City. TxDOT has expressed reservation with selling property.

	Sufficient Parcel Size (at least 20 acres) (able to provide approximately 284 ac-ft detention volumes)	Yes	N/A	N/A	Yes	Yes	No
		34.5 acres reserved	N/A	N/A	~44 acres	~30 acres	The separated parcels do not allow for large enough ponds to provide the required storage.
Logistics	Provided a Path for Positive Drainage?	Yes	Yes	Yes	Yes	Yes	No
		Pond would be pumped	San Jacinto River provides enough grade difference to provide positive drainage	MUD 95 channel provides enough grade difference to provide positive drainage	Drainage infrastructure will need to be constructed to route runoff to the pond	Drainage infrastructure will need to be constructed to route runoff to the pond	Too far upstream to eliminate all standing water
	Mitigate Increased Peak Flows	Yes	Yes	No	Yes	Yes	Yes
		Storage provided to reduce flow rate	Runoff could be stored within the drainage channel.	MUD 95 cannot take additional flows	Storage provided to reduce flow rate	Storage provided to reduce flow rate	Storage provided to reduce flow rate

Justification for the Preferred Design Alternative: There are several critical items which led to the selection of the Preferred Alternative. The following is the justification for the Applicant's preferred design solution:

1. The design solution had to be located within property owned by the City or within property that is available for acquisition. The preferred site is already owned by the City and there would be no need to acquire any additional land.
2. For any pond design solution, the site had to have sufficient area to be able to provide approximately 284 ac-ft worth of storage on top of any existing storage that the site may already be providing (if applicable). The preferred site, with at least 20-acres of available developable land, is sufficient size to provide a pond with a storage volume of 284 ac-ft.
3. The design solution had to adequately provide positive drainage inside the city limits that would eliminate permanent standing water upstream from the most easterly portion of the City near the Union Pacific Railroad. The pond is located along the east city limit line and just west of the Union Pacific Railroad. This location is sufficiently downstream to eliminate the standing water within the city limits. The preferred location is located along the Carter Slough Tributary ditch which already has adequate flow capacity already in place. Since the pond is being pumped, the pond will lower the standing water and control it as a wet-bottom amenity pond that can be maintained by the City.
4. The design solution had to adequately mitigate any increase in peak flow rates due to the removal of the existing natural storage, or a design accepted by the governing jurisdictions of any downstream channel or river that is accepting the increased peak flows. Additional storage above the existing natural storage is being provided so there where be no increase in peak flow rates from natural conditions.

Design Alternatives

Of the 5 design alternatives, only alternatives 2 and 5 are either owned by the City or available for acquisition. However, alternate 2 is not viable since the MUD 95 channel does not have any additional capacity available to take the direct rerouted flows from Carter Slough Tributary 1 and alternative 5 does not have enough room available to provide the expected required storage and additional storage, and it is not located far enough downstream to fulfill the city's purpose. Also, the Vision Park Regional Detention Pond is already providing storage for the Drainage

District 1 and it might not be able to take more storm flow from the City. Therefore, all offsite alternatives were rejected.

Pond Onsite:

Onsite Alternative (Preferred):

The preferred alternative will include the construction of drainage relief pond that doubles as a park and lake amenity for the city. The pond would include a water amenity level and landscaping to preserve and enhance the aesthetics and recreational potential of the site. The pond will also give the City control with flood mitigation.

The preferred alternative is the least environmentally damaging practicable alternative because it meets the site criteria and the project purpose and need, while proposing the minimum necessary impacts to waters of the U.S. necessary to complete the project. Below are the details of the proposed impacts by the project.

Waterbody ID[1]	Latitude and Longitude (Decimal Degrees)	Resource Type[2]	Acres in Project Area	Impact Type[3]	Acres of Impact
W1	30.192, -95.449	FW	3.9 acres	D/P	0.2 acre
W2	31.193, -95.446	NFW	2.9 acres	D/P	2.4 acres
W3	30.193, -95.445	NFW	0.3 acre	D/P	0.3 acre
W4	30.192, -95.449	FW	4.9 acres	D/P	4.9 acres
W5	30.193, -95.449	NFW	0.2 acre	D/P	0.2 acre
W6	30.193, -95.448	FW	1.0 acre	D/P	1.0 acre
W7	30.193, -95.447	NFW	1.4 acres	D/P	1.4 acres
W8	30.193, -95.445	NFW	0.2 acre	D/P	0.2 acre
W9	30.192, -95.445	NFW	10.8 acres	D/P	3.6 acres
OW1	30.193, -95.445	I	7.7 acres	D/P	7.7 acres
TOTAL			33.3 acres	D/P	21.9 acres

The project proposes to impact 6.1 acres of forested wetlands, 4.3 acres of emergent wetlands, 3.8 acres of shrub/scrub wetlands, and 7.7 acres of open water (pond). Please note that although the proposed project would impact a total of 21.9 acres of Waters of the U.S., approximately 11.4 acres of Waters of the U.S. would be completely avoided, and approximately 15.5 acres of open water habitat would exist upon project completion.

One onsite alternative that has been considered instead of excavating a large pond that doubles as a park amenity feature includes the construction of a small pump station that will lower the natural standing water by a few feet over the period of a week. The City wants to use this alternative as an intermediate phase until an ultimate permanent solution is provided. This will not function properly as a long-term solution since it only partially meets the need and purpose of the project. The existing pond acts a natural recreational area for residents who enjoy kayaking, canoeing, and fishing on the pond. Pumping down the water level without making any improvements to the area would greatly diminish its natural recreational amenity potential and the local aesthetics in the area. It will also not give the City any control with flood mitigation in the area. Since the pump station would be located out of the wetlands, we do not expect this alternative to have wetlands impacts.