# Attachment D
# Alternatives Analysis

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ATTACHMENT D

# Alternatives Analysis

The Alternatives Analysis details the full range of alternatives considered by Dow prior to pursuing a Section 404 permit for the Harris Expansion Project, and includes the framework used to analyze these alternatives and the evaluation criteria applied to identify those practicable[1] alternatives that meet the project purpose and need. This attachment also presents an analysis of alternative projects selected for further evaluation and the potential environmental consequences of those alternatives. The alternatives analysis presented herein demonstrates that:

1) There is not a practicable alternative to the proposed work, which would have less adverse impact on the aquatic ecosystem (so long as the alternative will not have other significant adverse environmental consequences);
2) It [the proposed project] does not violate a State water quality standard, violate a toxic effluent standard, jeopardize the continued existence of a threatened or endangered species, or violate protective requirements of a federal marine sanctuary;
3) It [the proposed project] will not result in significant degradation of waters of the U.S.; and
4) Appropriate and practicable steps will be taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (USACE 2003).

The amount of information needed to make such a determination and the level of scrutiny required by the U.S. Army Corps of Engineers' (USACE) Alternatives Analysis Guidance (USACE 2003) is commensurate with the severity of the environmental impact (as determined by the functions of the aquatic resource and the nature of the proposed activity) and the scope/cost of the project.

## Alternative Analysis Framework

Dow used a rigorous analysis framework to determine that there is not a readily apparent practicable alternative to the Harris Expansion Project which would meet the project purpose and need while having a less adverse impact on the aquatic ecosystem when other environmental impacts are considered. The analysis framework includes the following evaluation process:

- Identifies the full range of alternatives considered and screens out those alternatives found to be not practicable.
- Defines the criteria for evaluation of alternatives used to identify the least environmentally damaging practicable alternative to meet the project purpose and need.
- Provides a preliminary public interest review in which the comparison of public interest benefits verses detriments is framed with "yes" and "no" determinations with "yes" meaning public interest benefits accrued outweigh or are reasonably balanced against foreseeable detriments, and "no" meaning benefits accrued do not outweigh or are not reasonably balanced against foreseeable detriments.
- Those alternatives that have two or more of the following four screening factors were considered to be not practicable:
    - does not meet the purpose and need

[1] Practicable alternatives are those alternatives that are "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." (40 C.F.R. §230.3 (l))

- does not result in a discernible difference from other alternatives
- has "other significant adverse environmental consequences"
- is a Special Aquatic Site[2]

# Full Range of Alternatives

Dow identified a full range of (15) potential alternatives that were evaluated to meet the purpose and need for the project and that might be practicable. In addition, the No Action Alternative was evaluated. The 15 alternatives studied included non-structural and structural projects located near the Texas Operations site in Freeport and at more remote locations. **Figure D-1** shows the location of the 15 alternatives evaluated. These 16 alternatives (including the No Action Alternative) were initially screened to identify practicable projects that met the overall purpose of and need for the project. The full range of alternatives and initial screening to select alternatives for detailed evaluation are summarized in **Table D-1**.

[2] Special Aquatic Sites are afforded a higher level of scrutiny and protection. Special aquatic sites include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and stream riffle and pool complexes.

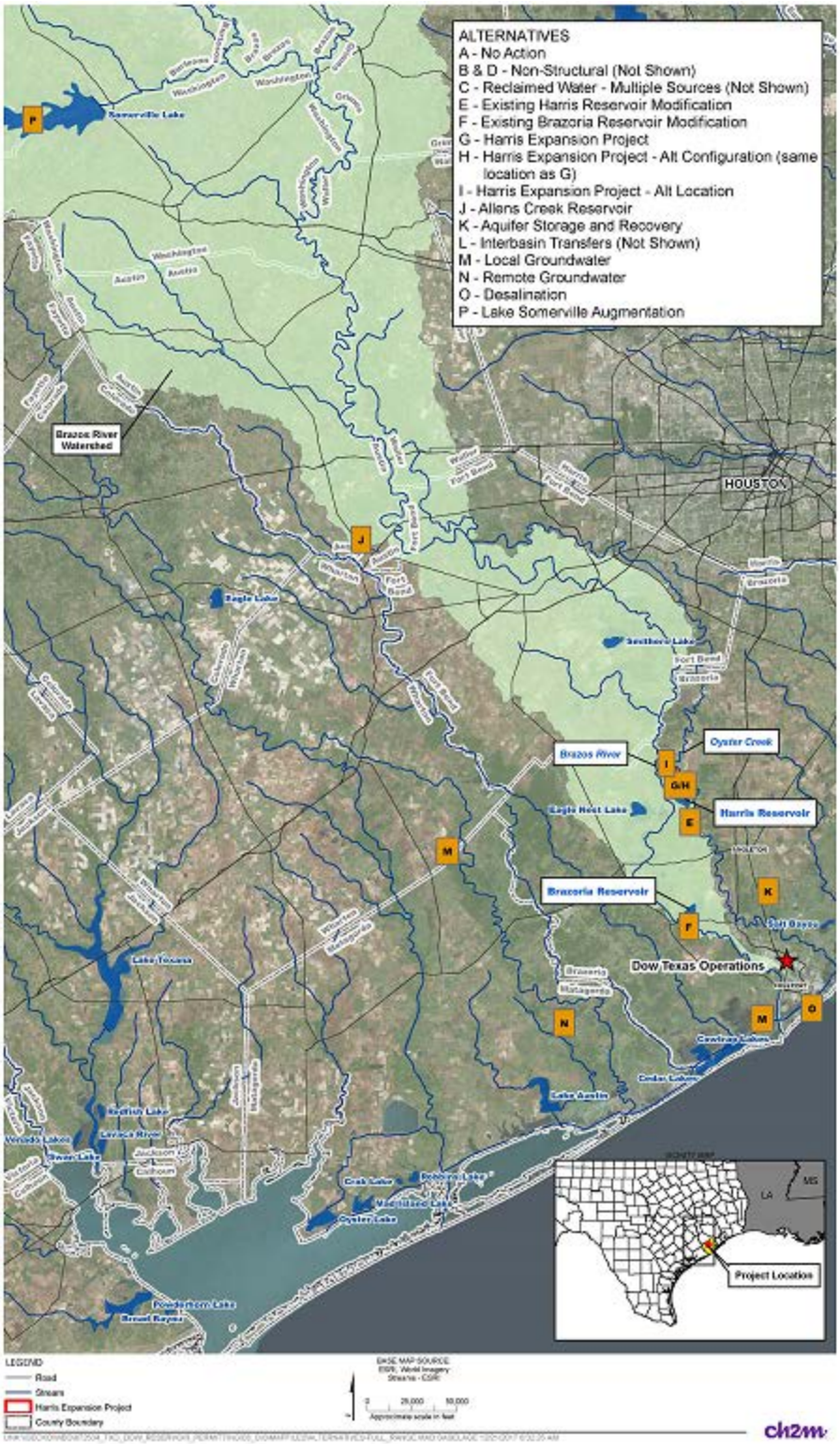



Figure D-1. Location of Full Range of Alternatives
*Harris Expansion Project Individual Permit Application*

Table D-1. Full Range of Water Supply Alternatives and Initial Screening

*Harris Expansion Project Individual Permit Application*

| Alternative Letter | Name | Description | Practicable | Meets Project Need | Special Aquatic Site [1] | Carried Forward for Alternative Analysis |
|---|---|---|---|---|---|---|
| Alternative A | No Action | The "No Action" alternative means that no additional water storage would be constructed and that the proposed activity would not take place and Dow would continue to operate their water supply system as is currently done. The No Action alternative would include Dow's current water conservation and water reclamation projects. The expiration of the stored water purchase agreement with the Brazos River Authority in 2021 is included. | N/A | No | N/A | Yes |
| Alternative B | Enhanced Conservation | The Enhanced Conservation alternative includes capital projects or operational changes within the Texas Operations site that would reduce water consumption by an additional 10 percent (approximately 20,000 acre-feet) per year. This alternative was not carried forward since it would not reduce risk associated with long-term average water storage capacity during extended drought nor meet the identified need for the project. | Yes | No | No | No |
| Alternative C | Expanded Reclaimed Water Use | The Expanded Reclaimed Water Use alternative includes use of municipal reclaimed water from the cities of Alvin and Freeport delivered via the bed and banks of Oyster Creek or via pipeline to the Texas Operations distribution system. The projected water demand in 2020 for the cities is 4,644 acre-feet and 1,283 acre-feet, respectively (*2016 Region H Regional Water Plan*). Assuming that 70 percent of water used is treated and discharged, up to approximately 4,150 acre-feet per year might be available for Dow's use. This volume is substantially below Dow's weekly water demand of approximately 3,000 acre-feet *per week*. This alternative was not carried forward since it would not provide sufficient volume to meet the identified need for the project, nor address storage during drought or water curtailment. | No | No | Potentially (conveyance system) | No |

Table D-1. Full Range of Water Supply Alternatives and Initial Screening

*Harris Expansion Project Individual Permit Application*

| Alternative Letter | Name | Description | Practicable | Meets Project Need | Special Aquatic Site [1] | Carried Forward for Alternative Analysis |
|---|---|---|---|---|---|---|
| Alternative D | Utilize Existing Stored Water or Under-utilized Run-of River Rights in Brazos River | The "Utilize Stored Water or Underutilized Run-of-River Rights in the Brazos River" alternative includes executing contract(s) with the Brazos River Authority (BRA) to purchase additional stored water from upstream reservoirs through an Interruptible Water Availability Agreement (IWAA) and supplementing with water rights acquisition or lease from other water right holders in the basin (Reddy, et al 2015). Available BRA storage reserves are fully contracted, it's reservoirs fill less frequently than lower basin storage alternatives and the BRA interruptible water policy no longer allows multiyear agreements (BRA 2017). Annual contracts of this nature do not provide long-term reliability and would have limited availability during drought. Due to the lack of available surface water rights that are reliably available during drought does not meet the purpose and therefore, this alternative was not carried forward. | No | No | No | No |
| Alternative E | Modification of Existing Harris Reservoir | The "Modification of the Existing Harris Reservoir" alternative includes activities such as dredging, deepening or raising the embankment of the existing Harris Reservoir to expand the storage capacity. This alternative was not carried forward because these activities cannot be performed at Harris Reservoir without disrupting the existing supply and thus the ongoing functionality of the Texas Operations during construction. There are also dam safety concerns with raising the existing embankment heights. For these reasons, the project was not carried forward. | No | No | No | No |
| Alternate F | Modification of Existing Brazoria Reservoir | The "Modification of the Existing Brazoria Reservoir" alternative includes activities such as dredging, deepening or raising the embankment of the existing Brazoria Reservoir to expand the storage capacity. This alternative was not carried forward because the salt water wedge prevents diversion at Brazoria Reservoir during low flow conditions and these activities cannot be performed without disrupting the existing supply and thus the ongoing functionality of the Texas Operations during construction. There are also dam safety concerns with raising the existing embankment heights. For these reasons, the project was not carried forward. | No | No | No | No |
| Alternative G | Harris Expansion Project | The "Harris Expansion Project" alternative includes construction of an off-channel reservoir north of the existing Harris Reservoir to add approximately 50,000 acre-feet of additional storage capacity. This is the proposed project. | Yes | Yes | Yes | Yes |

Table D-1. Full Range of Water Supply Alternatives and Initial Screening

*Harris Expansion Project Individual Permit Application*

| Alternative Letter | Name | Description | Practicable | Meets Project Need | Special Aquatic Site [1] | Carried Forward for Alternative Analysis |
|---|---|---|---|---|---|---|
| Alternative H | Harris Expansion Project – Alternate Embankment Configuration | The "Harris Expansion Project –Alternate Embankment Configuration" includes an alternate site layout for the construction of an off-channel reservoir north of the existing Harris Reservoir to add approximately 56,760 acre-feet of additional storage capacity (*2016 Region H Regional Water Plan*). | Yes | Yes | Yes | Yes |
| Alternative I | Harris Expansion Project – Alternate Location | The "Harris Expansion Project – Alternate Location" alternative is the result of Dow's site selection evaluation of 6 sites. While not carried forward to detailed design, it is assumed that it would provide a storage capacity comparable to Alternative G (approximately 50,000 acre-feet). Four of the six sites identified were not suitable due to technical, availability or cost considerations; Alternative G, the proposed project, and this alternative location were the only two deemed to be feasible (Dow 2015). | Yes | Yes | Yes | Yes |
| Alternative J | Allens Creek Reservoir | The "Allens Creek Reservoir" alternative includes construction of a proposed reservoir with storage capacity of up to 145,533 acre-feet and an approximate annual yield of 99,650 acre-feet in Austin County (*2016 Region H Regional Water Plan*). The alternative would include buying water from the Brazos River Authority and/or the City of Houston, if available, and releasing it downstream to Dow's diversion structures. | Yes | Yes | Yes | Yes |
| Alternative K | Aquifer Storage and Recovery | The "Aquifer Storage and Recovery (ASR)" alternative includes an ASR well field(s) (either 10 million gallons per day (MGD) or 14 MGD) in central Brazoria County near Brazosport Water Authority facilities that could be operated to store treated water during low demand months for retrieval and distribution during summer months. This would provide operational flexibility to maintain storage water in the existing Dow water system reservoirs. In addition to the wellfield, the alternative would include conveyance facilities to transport water to the Texas Operations distribution system and potentially a water treatment plant (HDR 2013). Assuming a 6-month fill and storage period and a 6-month recovery period, a 14 MGD facility would provide approximately 7,841 acre-feet per year. Because the yield is less than that needed for the project, this option was not carried forward. | Yes | No | Potentially – (conveyance system) | No |

Table D-1. Full Range of Water Supply Alternatives and Initial Screening

*Harris Expansion Project Individual Permit Application*

| Alternative Letter | Name | Description | Practicable | Meets Project Need | Special Aquatic Site [1] | Carried Forward for Alternative Analysis |
|---|---|---|---|---|---|---|
| Alternative L | Surface Water from Adjacent Basins | The "Surface Water from Adjacent Basins" alternative includes an interbasin transfer of water from the Colorado River to the west or the Trinity River to the east. Such interbasin transfers would include amending water rights, diversion and conveyance facilities and additional storage in the basin of origin (Colorado or Trinity River basin) or additional storage capacity near Texas Operations to create a reliable water supply that could be delivered at needed rates during drought conditions. This project was not carried forward due to the lack of surface water rights available for transfer and logistical reasons related to amending water rights, obtaining interbasin transfer authorizations and acquiring necessary rights-of-way or easements. Additionally, the potential for negative impacts to instream flows or freshwater inflows to bays and estuaries in the basin of origin is possible. This project has the potential to impact aquatic habitat in both the basin of origin and the receiving basin. Further, the complexity of surface water interbasin transfer authorizations would be expected to delay implementation beyond the project implementation timeframe. For these reasons, the project was not carried forward. | No | Yes | Yes | No |
| Alternative M | Local Groundwater Supply | The "Local Groundwater Supply" alternative includes construction of a well field in Brazoria or Matagorda counties to produce groundwater from the Chicot and Evangeline Aquifers and conveyance facilities to transport water to the Texas Operations distribution system (HDR 2013). This alternative was not carried forward because the current groundwater production in Brazoria and Matagorda counties is already equal to the established regulatory limit as determined by the "Modeled Available Groundwater (MAG)" volume and because of concerns about subsidence. Issued permits exceed the MAG; therefore, long-term production is not reliable. Due to the potential for subsidence and regulatory constraints, this alternative was not carried forward. | Yes | No | No | No |
| Alternative N | Remote Groundwater Supply | The "Remote Groundwater Supply" alternative includes construction of a well field in southeast Wharton County to produce up to 17,500 acre-feet/year of new water from the Chicot and Evangeline Aquifers in southeast Wharton County. Conveyance to the Texas Operations distribution system would be accomplished by pipelines and conveyance via the bed and banks of the Brazos River where it would be diverted into Dow's reservoirs and existing water supply system (HDR 2013). Because the yield is less than that needed for the project, this option was not carried forward. | Yes | No | Potentially – (conveyance system) | No |

Table D-1. Full Range of Water Supply Alternatives and Initial Screening

*Harris Expansion Project Individual Permit Application*

| Alternative Letter | Name | Description | Practicable | Meets Project Need | Special Aquatic Site [1] | Carried Forward for Alternative Analysis |
|---|---|---|---|---|---|---|
| Alternative O | Seawater Desalination | The "Seawater Desalination" alternative includes construction of a reverse osmosis treatment plant to produce 33,600 acre-feet per year of desalinated seawater water from the Gulf of Mexico and conveyance facilities to transport treated water to the Texas Operations water distribution system (2*011 Region H Regional Water Plan*, TWDB 2016). The project would include diversion of seawater using an existing intake facility, a reverse osmosis plant, an existing outfall to discharge brine concentrate into the Gulf of Mexico via the Brazos River and raw water and treated water conveyance facilities. To meet the project need, a desalination project would need to be expanded significantly from the representative projects previously studied. Note that this alternative presents an updated location for a potential desalination facility because the conceptual location of the 10 MGD alternative studied by the Region H Water Planning Group is no longer available. | Yes | Yes | Potentially–(conveyance system) | Yes |
| Alternative P | Lake Somerville Augmentation | The "Lake Somerville Augmentation" alternative includes construction of a pump station and pipeline to deliver high flows from the Brazos River to increase the firm yield up to an additional 22,800 acre-feet per year in the existing Lake Somerville located in Burleson, Lee and Washington counties (*2016 Region H Regional Water Plan*). The alternative would include buying water from the BRA and/or the City of Houston, if available and releasing water downstream to Dow's diversion structures. Due to uncertainty regarding availability of firm water supply, implementation schedule and the ability to meet Dow's water volume and delivery rates, this is not a practicable alternative to meet the purpose of and need for the project and was not carried forward for further evaluation | No | No | Yes | No |

Notes:

[1] Special aquatic sites include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and stream riffle and pool complexes (USACE, 2003. Alternative Analysis Guidance Date: 23 October 2003.

[2] There are a few water rights in Texas that include the explicit authorization for interbasin transfer without loss of seniority; however, those are not the standard water right.

# Alternative Evaluation Criteria

The alternatives carried forward for further analysis after the initial screening are those that are feasible to be implemented and that meet the need for the project. To the extent that readily available and comparable information exists, **Table D-2** outlines the 3-tiered system based on assigning value assessments of low (least favorable), medium and high (most favorable) to criteria used to evaluate and select those alternatives considered practicable[3] and selected for further analysis. The initial screening criteria used to determine the avoidance, minimization, and ecological impact extent to which an alternative is practicable include:

- The ability to meet the project's overall purpose of providing reliable water supply during drought
- The ability to meet the project's overall purpose of using existing Dow-owned surface water rights within the authorized diversion segment (at or near the existing Harris Reservoir)
- The relative logistical coordination needed to construct and operate the project
- The ability to meet the project purpose with existing technology
- The relative cost

The criteria for each factor are specific to achieving the need for and purpose of the project and were developed to facilitate comparison between a diverse range of alternatives. The results of applying the criteria in **Table D-2** to the 6 alternatives carried forward for detailed review are presented in **Table D-5** in the following section**.**

[3] As defined in 40 C.F.R. § 230.3, “practicable” alternatives are those alternatives that are "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

Table D-2. Evaluation Criteria for Practicability of Alternative Projects

*Harris Expansion Project Individual Permit Application*

| **3- tiered Rating System** | **Low** | **Moderate / Limited** | **High** |
|---|---|---|---|
| **Rating Symbol** | ○ | ◒ | ● |
| **Overall Project Purpose Factors** | | | |
| Ability to provide reliable water supply for Texas Operations during extended drought (reliable is defined as: 1) available during a drought, and 2) able to deliver supply at rates equal to water demand to Dow and those they serve on a daily/weekly basis) | No | When combined with other sources | Yes |
| Ability to use existing Dow-owned surface water rights diverted within the authorized diversion segment | No | With loss of seniority of water rights. | Yes |
| **Logistical Factors** | | | |
| Ability to be operational within five years | Extended or uncertain schedule | Potentially operational, but uncertain | Highly likely for substantial completion within five years |
| Property rights / # of property owners affected | More than 5 property owners and / or unwilling to sell. | Fewer than 5 property owners and / or willing to sell. | Not Applicable or Single Owner |
| Conveyance distance to existing conveyance system (greater distances reduce reliability due to main breaks) | Long distance (>20 miles) | Medium distance (>5 and <20 miles) | Reasonably close (< 5 miles) |
| Water availability/ water right availability to Dow (either new permits or through agreement/ acquisition) | Less than 17,500 acre-feet | Between 17,500 - 47,000 acre-feet | 47,000 acre-feet or more |
| **Technology Factors** | | | |
| Project capable of high delivery rates (e.g., 3000 acre-feet per week) with reasonably-sized capital facilities | No | Limited | Yes |
| Project capable of being constructed with existing water supply system (Harris and Brazoria reservoirs) remaining in operation | No | Potentially, but with difficulty and at a high construction cost | Yes |
| **Relative Cost Factors** | | | |
| Annualized unit cost per acre-foot per year (capital and operations & maintenance) | Annualized unit cost per acre-foot per year (capital and operations & maintenance) | Annualized unit cost per acre-foot per year (capital and operations & maintenance) | Annualized unit cost per acre-foot per year (capital and operations & maintenance) |
| Unit capital cost per acre-foot | Unit capital cost per acre-foot | Unit capital cost per acre-foot | Unit capital cost per acre-foot |
| Availability of suitable land for project at reasonable cost | Availability of suitable land for project at reasonable cost | Availability of suitable land for project at reasonable cost | Availability of suitable land for project at reasonable cost |

After the screening to select which projects could potentially and practicably achieve the purpose and need for the project (summarized in Table D-1), the 6 project alternatives carried forward for detailed analysis were evaluated using the environmental impact criteria in **Table D-3**, again following a 3-tiered system based on value assessments with low (most favorable), medium and high (least favorable) to identify the least environmentally damaging practicable alternative. Qualitative values were used for the environmental impact analysis because quantified data were not available for all alternatives.

Table D-3. Evaluation Criteria for Environmental Impact Factors
*Harris Expansion Project Individual Permit Application*

| **3- tiered Rating System for Impacts** | **Low** | **Moderate** | **High** |
|---|---|---|---|
| **Rating Symbol** | ○ | ◒ | ● |
| Potential for impacts to critical habitat or listed threatened or endangered fish and aquatic species | No effect | May affect, but not likely to adversely affect | May affect, and is likely to adversely affect |
| Potential impacts to surface water quality (or violation of State water quality standards) | No impacts | Temporary, indirect, and short-term impacts | Adverse, direct, and long-term impacts |
| Potential for impacts to wetlands and other Waters of the U.S. | No impacts to wetlands or other WOUS | Impacts to <50 acres of wetlands or other WOUS | Impacts to ≥50 acres of wetlands or other WOUS |
| Potential for impacts to aquatic ecosystem/ instream flows | No impacts | Temporary, indirect, and short-term impacts | Adverse, direct, and long-term impacts |
| Potential for impacts to land (e.g. subsidence and impacted area not owned by Dow) | No impacts | Temporary, indirect, and short-term impacts | Adverse, direct, and long-term impacts |
| Potential for impact to cultural resources | No undertaking/no potential to cause effects | Undertaking might affect cultural resources | Undertaking may adversely affect cultural resources |
| Potential for impacts related to energy requirements (e.g., greenhouse gas and impacts of locating sufficient energy supply to meet peak delivery rates) | No impacts | Temporary, indirect, and short-term impacts | Adverse, direct, and long-term impacts |

# Alternatives Carried Forward for Detailed Evaluation

Of the 16 alternative projects identified, 6 alternatives, including the No Action and Preferred Alternative (the proposed project), were selected for detailed analysis. A detailed description of these alternatives and their anticipated environmental consequences are presented herein. **Table D-4** summarizes the 6 alternatives carried forward for detailed evaluation and **Figure D-2** shows their locations. (Please note that the alternative projects carried forward were given new identification numbers (as shown in **Table D-4**) to avoid reader confusion of missing alphabetically identified project alternatives in the detailed analysis.)

This section presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options. For the proposed project, a comparison of options for the project components (e.g., type and size of the pump station, intake facilities and impoundment) was also conducted. A description of each alternative, summary of practicability factors and the potential environmental consequences associated with the alternative are presented. The results of the evaluation for practicability using the ranking system and criteria presented in **Table D-2** for the 6 alternatives carried forward for detailed review are presented in **Table D-5** followed by and a summary of environmental consequences presented in **Table D-6**.

Table D-4. Alternatives Carried Forward for Detailed Analysis
*Harris Expansion Project Individual Permit Application*

| Alternative # | Name | Practicable | Meets Project Need | Special Aquatic Site [1] | Preliminary Alternative Letter |
|---|---|---|---|---|---|
| 1 | No Action | N/A | No | N/A | A |
| 2 | Harris Expansion Project | Yes | Yes | Yes | F |
| 3 | Harris Expansion Project –Alternate Embankment Configuration | Yes | Yes | Yes | H |
| 4 | Harris Expansion Project – Alternate Location | Yes | Yes | Yes | I |
| 5 | Allens Creek Reservoir | Yes | Yes | Yes | J |
| 6 | Seawater Desalination | Yes | Yes [2] | Yes | M |

Notes:

[1] Special aquatic sites include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and stream riffle and pool complexes (USACE, 2003) Alternative Analysis Guidance Date: 23 October 2003).

[2] At the yield evaluated, the seawater desalination project would not meet the project need; however, it is assumed in this analysis that the plant could be upsized to provide the necessary water supply.

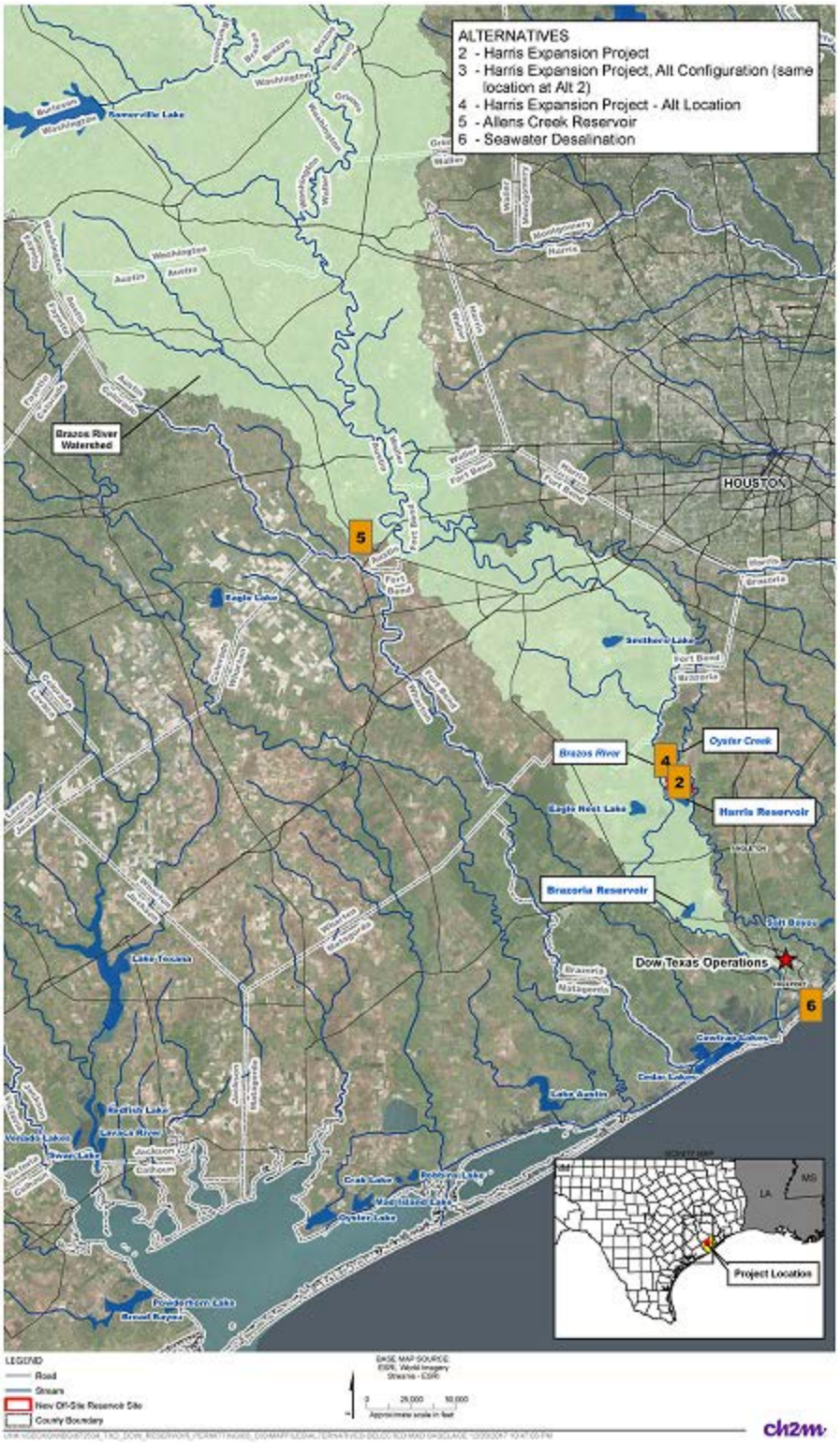



Figure D-2. Location of Alternatives Carried Forward for Detailed Analysis
*Harris Expansion Project Individual Permit Application*

# Alternative 1 - No Action Alternative

## Description

Under the No Action alternative, Dow's Texas Operations would continue to provide water supply for the facilities and other customers that rely on the water supply from Dow's current system. Dow would not construct the Harris Expansion Project and would, therefore, not have required storage capacity to sustain operations during an extended drought. The project goals would not be met.

The "No Action" alternative means that no additional water storage would be constructed and Dow would continue to operate their water supply system as they are currently. It includes Dow's existing water conservation and reclaimed water projects as well as a stored water purchase agreement for an annual average volume of 16,000 acre-feet with the Brazos River Authority that expires within 5 years. Therefore, this alternative will not achieve the project's purpose and need.

## Practicability Factors

The practicability factors do not apply to this alternative.

## Consequences

The No Action alternative does not meet the purpose of and need for the project.

Failure to provide a reliable water supply during drought for the Texas Operations site in Freeport and the other industries and municipalities that rely on Dow's water storage system could result in slowing production or shutting down operations for some period. This would have significant negative consequences on the 3,300 employees and 3,200 contract employees employed at the Texas Operations and the local and state economy. Dow pays an estimated $186.3 million in state taxes and an estimated $73.8 million in taxes to Brazoria County. Further, Dow contributes to the private sector economy with an approximate $685 million and $2.6 billion in purchases within Brazoria County and Texas, respectively (Dow 2016).

Given the reliance of industries and businesses across the country and internationally on products produced at the Texas Operations site, the negative consequences of potential materials and product shortages could impact the national and global economy. Combined with the local and state impacts, not meeting the water needs at Dow's Texas Operations site in Freeport would have severe negative socioeconomic consequences.

The no action alternative could potentially result in negative environmental consequences if the plant had to shut down on an emergency basis.

# Alternative 2 – Harris Expansion Project (Proposed Project/ Preferred Alternative)

## Description

The "Harris Expansion Project" alternative includes construction of expanded water storage capacity in an off-channel reservoir located north of the existing Harris Reservoir to add approximately 50,000 acre-feet of additional storage capacity and estimated annual yield of approximately 80,000 acre-feet.

**Figure D-3** presents the proposed location of and site lay-out for the Harris Expansion Project.

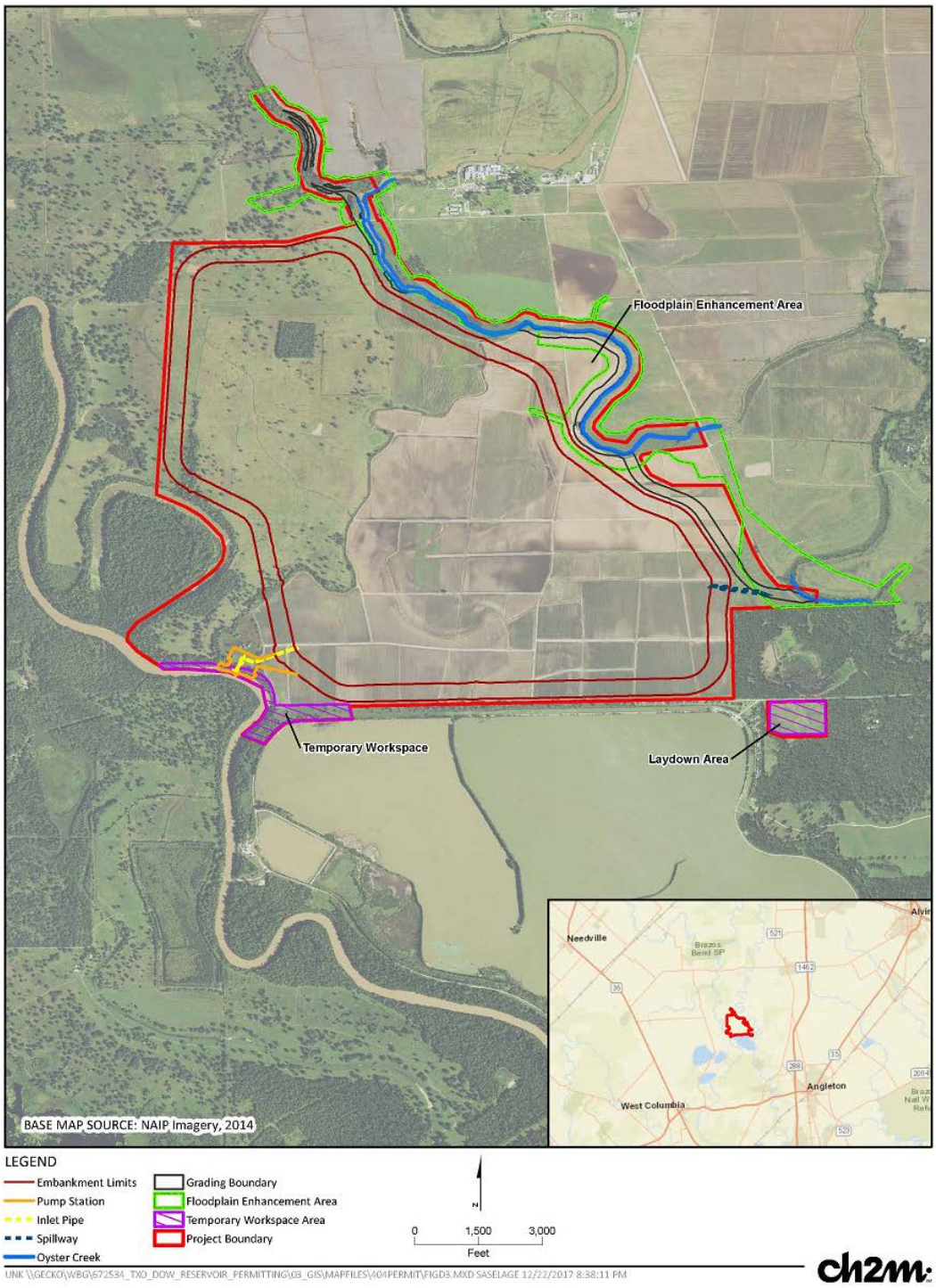



Figure D-3. Harris Expansion Project
*Harris Expansion Project Individual Permit Application*

## Practicability Factors

**Logistical Factors:** Because land acquisition and concept-level design have been completed, it is estimated that the project could be operational within five years. Furthermore, Dow currently owns sufficient surface water rights authorized for diversion, storage and use for the project. The outlet works would discharge water directly into Oyster Creek. This alternative received a high rating for the 4 logistical factors.

**Technology Factors:** The project is capable of delivering water for the Texas Operations at the high rates required and can be constructed while the current storage and conveyance system is in operation. This alternative received a high rating for the 2 technology factors.

**Relative Cost Factors:** Planning level costs estimates prepared by the Region H Regional Water Planning Group indicate that the annualized capital and operational costs for the proposed project would be slightly more than $300/acre-foot/ year and capital costs would be approximately $2,810 per acre-foot (one-time cost not annualized over time). Dow currently owns the 2,200-acre site for the impoundment. This alternative received a high rating for the 3 relative cost factors.

*The proposed project is a practicable alternative to meet the need for the project.*

### Consequences

**Threatened and Endangered Species:** No federally or state listed species were observed at the site during field investigation surveys conducted in 2012 and 2016. Construction for the proposed project would result in the permanent inundation of emergent and forested wetlands, which could provide marginal habitat for the state-threatened timber rattlesnake (*Crotalus horridus*). However, no timber rattlesnakes were observed during the site visits and best management practices (BMPs) will be implemented during construction to ensure no potential adverse impacts to the species. Construction of the proposed project would impact agricultural and heavily grazed areas which do not provide suitable habitat for protected species. A review of the Texas Natural Diversity Database (TXNDD) identified occurrences of bald eagles (*Haliaeetus leucocephalus*) and colonial wading bird colonies within the southern portion of the proposed project area. However, no bald eagles or their nests and no colonial wading bird colonies were observed during the site visits. Construction BMPs will be implemented to avoid impacts to migratory species.

No designated critical habitat, as defined by the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended, ESA), is in or near the project area. There would be no impacts to critical habitat.

No impacts to threatened and endangered species are anticipated as a result of the proposed project.

**Water Quality:** Minor, short-term impacts to water quality may occur during or after construction as a result of the proposed project. Surface water quality in the Brazos River and Oyster Creek could be temporarily impacted as a result of the construction of the pump station, reservoir outlet works, spillway and bank stabilization near those facilities. All practicable steps, including the use of BMPs, would be taken to minimize these impacts. Potential discharges to the impaired stream segment of Oyster Creek as a result of the proposed project could provide long-term, beneficial impacts to the stream by providing flow during low flow conditions.

For land-disturbing activities greater than 5 acres in size, a Large Construction Storm Water Permit (General Permit TXR150000), is required and will be obtained from the Texas Department of Environmental Quality (TCEQ) prior to initiation of clearing and grading activities associated with construction of the proposed project (TCEQ 2016a). Appropriate BMPs to minimize impacts associated with erosion would be implemented in accordance with TXR150000 and the Stormwater Pollution Prevention Plan (SWPPP) prepared for the project.

Permanent erosion controls and stormwater management measures will be implemented as permanent features to manage onsite runoff from the embankment as needed on the site.

Water Quality Certification as required under Section 401 of the CWA will be requested from the TCEQ as part of the Individual Permit application. See Section F for the Tier II questionnaire and checklist.

**Wetlands and waters of the U.S.:** Direct impacts to waters of the U.S. caused by the proposed project would include inundation of wetlands and streams located within the embankment areas. The

construction of the proposed project would result in the loss of 12.19 acres of emergent wetlands, 4.15 acres of forested wetlands, and 20,486.3 linear feet (5.73 acres) of streams. Compensatory mitigation would be required as a result of adverse impacts to wetlands and waters of the U.S. Using the criteria established in Table 2-3, moderate impact to wetlands and streams would result. After mitigation, impacts are expected to be minor.

**Aquatic Habitat:** Impacts to aquatic habitat as a result of the preferred alternative would be minor. The proposed project is not located within or adjacent to Essential Fish Habitat (EFH). Construction of the pump station could negatively impact mussel species (if present) as a result of decreased water quality during the construction phase of the project. However, a 2012 freshwater mussel survey conducted approximately 3,970 feet downstream of the project site found no evidence of live mussel, shell, or fragment (HDR 2012). The conversion of free-flowing streams within the impoundment boundary to an impoundment would alter the type and quality of aquatic habitat within the proposed reservoir site. However, the majority of the streams are low quality, ephemeral streams that provide little to no fish habitat, and aquatic life is limited. Construction of the proposed project would result in long-term beneficial impacts on aquatic habitats by creating a large waterbody that would provide suitable habitat for fish, migratory birds and colonial wading birds that is expected to provide ecological benefits greater than current low quality wetlands and drainage ditches.

**Land Resources:** Minor impacts to land resources would be anticipated as a result of the proposed project. The proposed site is not subject to local/regional zoning or land use development regulations, so there would be no impacts related to incompatible zoning. The proposed alternative would inundate approximately 1,900 acres of open space. Construction of the electrical, pump station, and operations buildings and associated facilities would result in the development of approximately 8.7 acres of open space.

**Cultural Resources:** One prehistoric archaeological site, two historic archaeological sites, one surface scatter of historic artifacts, found out of context, and one isolated artifact were identified within the 2,200-acre property of proposed project area. The prehistoric archaeological site (PS-1) and a historic residence (HS-1) could be considered eligible for listing on the National Register of Historic Places. Identification of site HS-1 resulted in a reconfiguration of the proposed embankment to ensure this historic site would not be impacted. PS-2 and a second historical site (HS-2) will be inundated by the reservoir (Griggs 2018).

A second archaeological investigation was conducted within the drainage enhancement area along Oyster Creek. Two historic archaeological sites, four surface scatters of historic artifacts found out of context, and a subsurface scatter were identified within the project area. The two sites could be considered eligible for listing on the National Register of Historic Places (Griggs 2017). These sites lie outside of the proposed floodplain enhancement projects and will not be impacted.

Impacts from the preferred alternative would be moderate; mitigation may be required in consultation with the Texas Historical Commission (THC).

No impacts to Native American Traditional Cultural Properties would be expected from implementation of the preferred alternative.

Attachment G includes detailed cultural resources reports presenting the results of intensive investigations of the properties.

**Energy Use/ Green House Gas Contribution:** The preferred alternative would contribute to minor short-term increases in greenhouse gas (GHG) emissions. Vehicle and equipment used during construction would be expected to create dust and fugitive emissions.

In the case of a newly formed reservoir, there tends to be a peak in emissions during the first two to three years following inundation as flooded vegetation decomposes. However, after a period of time, a

reservoir can reach a steady state that is similar to that of surrounding natural waterbodies (Soumis et al. 2005).

Impacts from the preferred alternative to greenhouse gas emissions would be minor.

## Alternative 3 – Harris Expansion Project –Alternate Embankment Configuration

### Description

The "Harris Expansion Project –Alternate Embankment Configuration" includes an alternative site lay-out for the construction of an expansion off-channel reservoir north of the existing Harris Reservoir to add 56,760 acre-feet of additional storage capacity to Dow's water supply system (*2016 Region H Regional Water Plan*). This layout, shown in **Figure D-4,** roughly parallels the site's property boundaries and has a slightly larger footprint than the proposed Project. Other project components would be the same as those described for the proposed project.

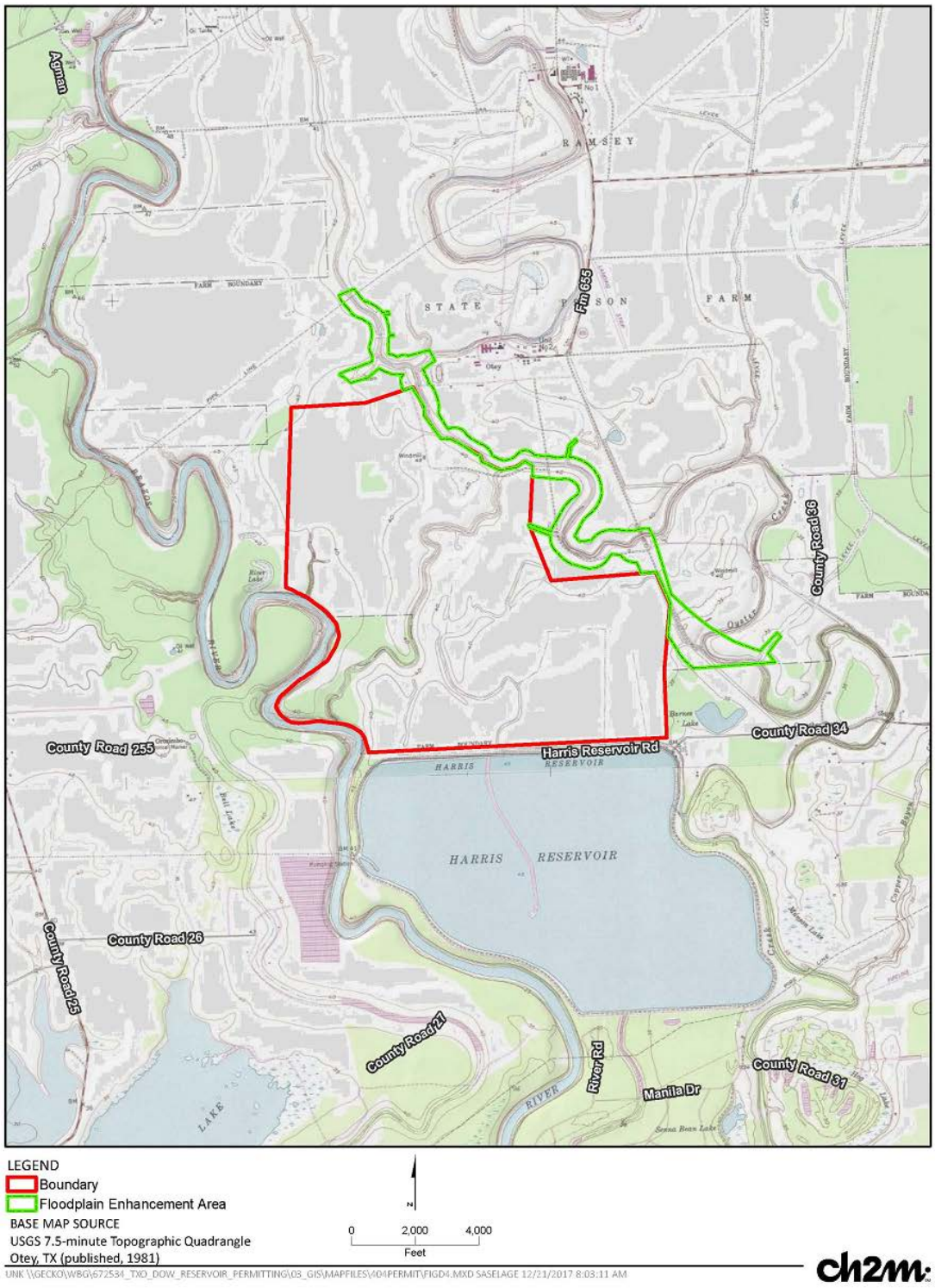



Figure D-4. Harris Expansion Project – Alternative Embankment Configuration
*Harris Expansion Project Individual Permit Application*

## Practicability Factors

**Logistical Factors:** Because land acquisition and concept-level design have been completed, it is estimated that the project could be operational within five years. Furthermore, Dow currently owns sufficient Brazos River surface water rights authorized for diversion, storage and use for the project. The

outlet works would discharge water directly into Oyster Creek. This alternative received a high rating for the 4 logistical factors.

**Technology Factors:** The project is capable of delivering water for the Texas Operations at the high rates required and can be constructed while the current storage and conveyance system is in operation. This alternative received a high rating for the 2 technology factors.

**Relative Cost Factors:** Planning level costs estimates prepared by the Region H Regional Water Planning Group indicate that the annualized capital and operational costs for this alternative would be slightly more than $300/acre-foot/ year and capital costs would be approximately $2,810 per acre-foot (one-time cost not annualized over time). Dow currently owns the 2,200-acre site for the impoundment. This alternative received a high rating for the 3 relative cost factors.

*This alternative practicable and would meet the need for the project.*

### Consequences

**Threatened and Endangered Species:** Impacts to threatened and endangered species under Alternative 3 would be comparable to the Preferred Alternative.

**Water Quality:** Impacts to water quality under Alternative 3 would be comparable to the Preferred Alternative.

**Wetlands and waters of the U.S.:** Surface water quality impacts to the Brazos River and Oyster Creek would be comparable to the preferred alternative. Compared with the preferred alternative, Alternative 3 would result in increased impacts to wetlands and other water of the U.S. do to the inundation of an additional wetlands and streams in the southwest portion of the project.

**Aquatic Habitat:** Impacts to aquatic habitat under Alternative 3 would be comparable to the Preferred Alternative.

**Land Resources:** Impacts to land resources under Alternative 3 would be comparable to the Preferred Alternative.

**Cultural Resources:** The historic sites and artifacts and prehistoric sites described for Alternative 2 (preferred alternative) are present within the project area for Alternative 3. Impacts to cultural resources associated with this project would be higher than those resulting from the proposed project due to the inundation of Historical Site 1. Development of mitigation in consultation with the Texas Historical Commission (THC) may be required.

No impacts to Native American Traditional Cultural Properties would be expected from implementation of the preferred alternative.

Attachment G includes detailed cultural resources reports presenting the results of intensive investigations of the properties.

Impacts to cultural resources under Alternative 3 would be moderate to high.

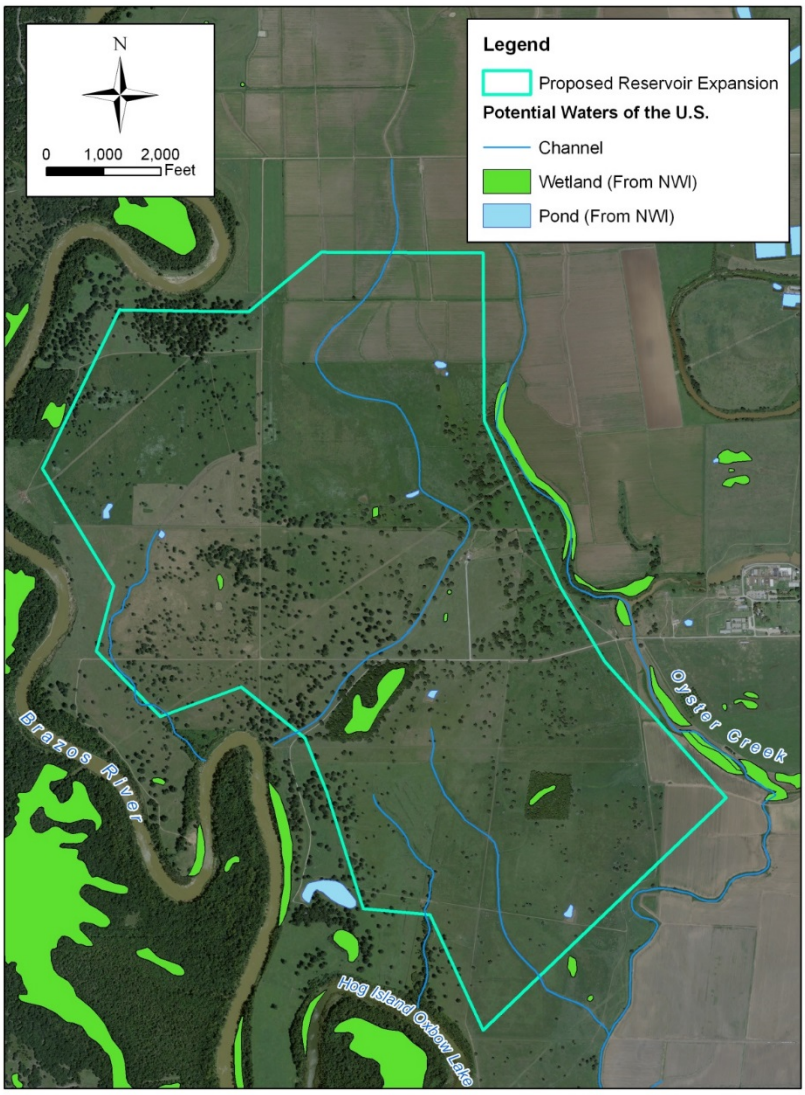
**Energy Use/ Green House Gas Contribution:** Impacts to energy use/GHG contributions under Alternative 3 would be comparable to the Preferred Alternative.

Environmental impacts to wetlands and water of the U.S. and cultural resources potentially resulting from the Harris Expansion Project – Alternate Configuration alternative are greater than those associated with the Preferred Alternative.

# Alternative 4 – Harris Expansion Project – Alternate Location

## Description

The "Harris Expansion Project – Alternate Location" alternative includes a site approximately 1.7 miles upstream from the proposed project. This location for the off-channel reservoir would provide approximately the same volume of storage capacity (approximately 45,000 – 50,000 acre-feet). Other project components would be similar to those for the proposed Harris Expansion Project (Alternative 2) and would operate in a similar fashion. **Figure D-5** illustrates the alternative location. The location in this alternative presents a technically feasible location for the off-channel reservoir.




Source: Dow 2015

Figure D-5. Harris Expansion Project – Alternate Location
*Harris Expansion Project Individual Permit Application*

## Practicability Factors

**Logistical Factors:** Land acquisition and concept-level design have not been initiated for this alternative location. The project could be potentially operational within five years; however, the development schedule is uncertain. This alternate was rated as moderate/ limited for ability to be operational within five years. While the number of affected property owners is low, the current use of the site suggests that one or more sellers would be unwilling to sell the property resulting in a low rating for the land availability factor. The conveyance distance to the existing system operated by Dow for the Texas Operations site and Brazosport Water Authority is greater than for Alternatives 2 and 3. The rating for distance from conveyance factor is moderate/ limited. Dow currently owns sufficient surface water rights authorized for diversion, storage and use for this alternative; it was given a high rating for the water availability factor.

**Technology Factors:** The project is capable of delivering water for the Texas Operations at the high rates required and can be constructed while the current storage and conveyance system is in operation. This alternative received a high rating for the 2 technology factors.

**Relative Cost Factors:** Planning level costs estimates prepared by the Region H Regional Water Planning Group developed for the Harris Expansion Project indicate that the annualized capital and operational costs for this alternative would be slightly more than $300/acre-foot/ year and capital costs would be approximately $2,810 per acre-foot (one-time cost not annualized over time). For the purposes of this analysis, capital and operating costs are assumed to be approximately the same as for Alternatives 2 and 3. Dow does not own the site for this alternative location for the impoundment. This alternative received a high rating for the 2 annualized and operating cost factors and a low rating for availability/ cost to acquire land factor.

*This alternative is practicable and would meet the need for the project; however, land availability provides constraints to its implementation and may render it infeasible due to logistical factors.*

## Consequences

**Threatened and Endangered Species:** The Alternative 4 site is located approximately 1.7 miles upstream from the Preferred Alternative site and habitat is not expected to be substantially different between the sites. Therefore, impacts to threatened and endangered species under Alternative 4 would be comparable to the Preferred Alternative.

**Water Quality:** Impacts to water quality under Alternative 4 would be comparable to the Preferred Alternative.

**Wetlands and waters of the U.S.:** Based on National Wetlands Inventory (NWI) and National Hydrography Dataset (NHD), five potential wetlands, six ponds, and three potential streams would be impacted by the impoundment. Five potential wetlands, three ponds, and numerous streams also would be impacted by the Preferred Alternative. Based on NWI and NHD data, impacts to wetlands and waters of the U.S. at Alternative 4 would be comparable to impacts for the Preferred Alternative. The NWI maps for this alternative have not been field verified and are only an interpretation of potential wetlands identified from an aerial photograph. Surface water quality impacts to the Brazos River and Oyster Creek would be comparable to the Preferred Alternative.

**Aquatic Habitat:** The Alternative 4 site is located approximately 1.7 miles upstream from the Preferred Alternative site, but it is unlikely that the substrate composition of the Brazos River would vary significantly from that of 2012 mussel survey site located south of the existing Harris Reservoir. Similar types of aquatic habitat exist on both sites and would be impacted in the same manner. Therefore, impacts to aquatic habitat as a result of Alternative 4 would be comparable to the Preferred Alternative.

**Land Resources:** The proposed site is not subject to local/regional zoning or land use development regulations, so there would be no impacts related to incompatible zoning. However, approximately

2,000 -2,200 acres of land would be inundated within the embankment on land currently not owned by Dow. Impacts to land resources as a result of Alternative 4 would be comparable to the Preferred Alternative.

**Cultural Resources:** A cultural resources investigation has not been conducted for the proposed alternative site. Given the proximity to the Preferred Alternative site, it is likely that cultural sites associated with Austin's Colony would be located on the proposed alternative site. Thus, it is anticipated that the project would have similar impacts on cultural resources as the Preferred Alternative.

**Energy Use/ Green House Gas Contribution:** Impacts to energy use/GHG contributions under Alternative 4 would be comparable to the Preferred Alternative.

Environmental impacts potentially resulting from the Harris Expansion Project – Alternate Location alternative would be expected to be comparable with the Preferred Alternative.

## Alternative 5 - Allens Creek Reservoir

### Description

The "Allens Creek Reservoir" alternative includes construction of a proposed reservoir with storage capacity of up to 145,533 acre-feet and an approximate annual yield of 99,650 acre-feet proposed in Austin County, Texas. The yield of the reservoir is primarily composed of diversions from the mainstem of the Brazos River which would be pumped via one or two pumps to the impoundment formed by a dam on Allens Creek. The maximum permitted diversion rate is 2,200 cubic feet per second (cfs) or approximately 1,400 MGD (*2016 Region H Regional Water Plan*). The proposed location of the Allens Creek Reservoir is shown in **Figure D-6**.

Surface water diversion and impoundment is authorized by a surface water right held jointly by the City of Houston, the Brazos River Authority and the Texas Water Development Board. Efforts to design and permit the reservoir were initiated by the Brazos River Authority during 2016. Construction is anticipated to be complete in approximately 10 - 15 years (2025 – 2030). Upon completion, water would be sold by the City or the Brazos River Authority to water users throughout the region. This alternative would include buying water from the Brazos River Authority, if available, and releasing it downstream to Dow's diversion structures.

Practicability Factors

The Allens Creek Reservoir alternative would not be able to utilize existing Dow-owned water rights and does not fully meet the project need; however, it was studied in more detail due to its potential to meet the water supply volume required.

**Logistical Factors:** The Brazos River Authority has initiated steps to develop the Allens Creek Reservoir; however, construction is not expected to begin until 2022 at the earliest. This means that the project will not be operational within five years and the project was given a low rating for that logistical factor. As noted, most of the land has been acquired and the additional property acquisition is anticipated to be completed resulting in a high rating for the affected properties factor. The reservoir is located immediately upstream of the existing Dow intake structure at the existing Harris Reservoir, resulting in a moderate/limited rating for conveyance distance.

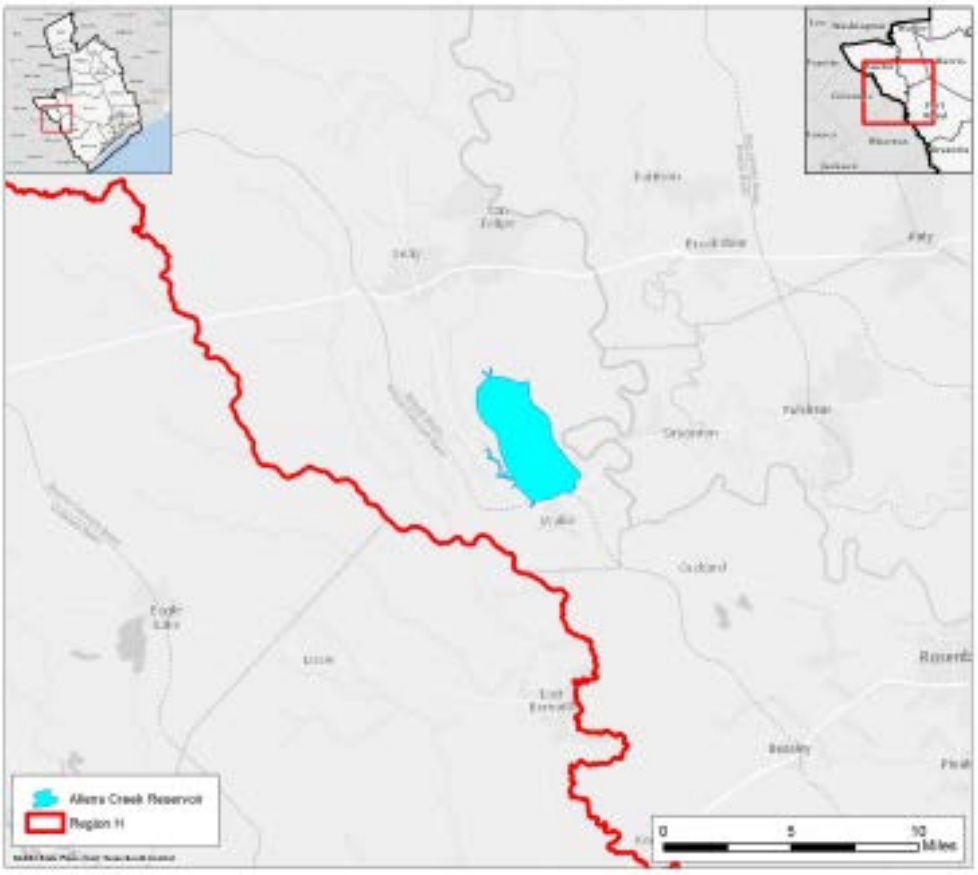
The Brazos River Authority owns 30 percent of the surface water right associated with Allens Creek Reservoir which equates to their allocation being 29,895 acre-feet of firm yield from the project. According to the 2016 Region H Regional Water Plan, however, water supply from the proposed Allens Creek Reservoir has been allocated for projected increases in water demands throughout the region for municipal, agricultural and other manufacturing/industrial sectors. Because the supply is allocated for growth in these sectors, it is not reliably available for Dow's use to reduce the risk of water shortage during drought to meet its current water demands. While it is possible that some portion of the firm

yield from Allens Creek could be available as an interruptible supply from the Brazos River Authority in the near-term, this would result in a variable water supply during drought which could result in operational impacts (e.g., production interruption) to the facilities at Texas Operations. It is unlikely that the majority of the project's calculated yield would be available for Dow's use over the long-term – particularly at the delivery rates needed during drought conditions. Therefore, a low rating was assigned for the water availability to Dow factor.

**Technology Factors:** The project is capable of delivering water for the Texas Operations, but is unlikely to meet the high delivery rates required during drought in light of demands by other customers. A low rating for the peak-delivery capacity was assigned. The project can be constructed while the current storage and conveyance system is in operation resulting in a high rating.

**Relative Cost Factors:** Planning level costs estimates prepared by the Region H Regional Water Planning Group developed for the Allens Creek Reservoir indicate that the annualized capital and operational costs for this alternative would be $231/acre-foot/ year and capital costs would be $3,173 per acre-foot (one-time cost not annualized over time). Most of the land needed to construct the Allens Creek Reservoir project has been acquired and the additional land required for the project is expected to be acquired in the near future. This alternative received a high rating for the 3 relative cost factors.

*This alternative is practicable and would meet the need for the project; however, the expected development timeframe, allocation of its yield to others in the basin and uncertainty regarding its ability to meet peak delivery requirements during drought create uncertainty as to its ability to meet the project need.*




*Source: 2016 Region H Water Plan*

Figure D-6. Allens Creek Reservoir Location
*Harris Expansion Project Individual Permit Application*

### Consequences

**Threatened and Endangered Species:** According to the 2016 Region H Water Plan (*2016 Region H Regional Water Plan*, Freese and Nichols (FNI) 2000), 19 species classified as threatened or endangered by the U.S. Fish and Wildlife Service or Texas Parks and Wildlife Department are found in Austin County. None have been observed on the property; therefore, impacts are expected to be minor.

**Water Quality:** Due to agricultural land uses in the project area, Allens Creek is highly nutrient enriched with low dissolved oxygen concentrations. The proposed reservoir is not expected to increase water concerns in the Brazos River; retention time in the reservoir could provide opportunities for nutrients to be removed (FNI 2000). Therefore, impacts to water quality are expected to be comparable to the Preferred Alternative.

**Wetlands and waters of the U.S.:** Previous wetland delineations at the project location indicate that approximately 1,428 acres of wetlands would be impacted with the original design. The design was modified to avoid most of the 723-acre Alligator Hole wetland, leaving approximately 700 acres of the original 1,428 delineated acres that would be impacted (FNI 2000). Impacts to wetlands would be major without mitigation as compared with the Preferred Alternative.

**Aquatic Habitat:** Several fish studies have been conducted for Allens Creek. Allens Creek has a rich diversity of fish species, but not abundant game species. (FNI 2000). Impacts to aquatic habitat would be moderate and greater than those expected with the Preferred Alternative.

**Land Resources:** The Allens Creek reservoir would inundate approximately 7,003 acres (FNI 2000, *2016 Region H Regional Water Plan*). Impacts to land resources would be greater compared with the Preferred Alternative inundation of approximately 1,900 acres.

**Cultural Resources:** During the original studies conducted for the reservoir, 33 aboriginal sites three of which indicate human habitation, a burial ground from 650 B.C. to A.D. 950 with 238 burials and a second burial site were identified (FNI 2000). Major impacts to cultural resources would result from Allens Creek and would be substantially greater than those potentially resulting from the Preferred Alternative.

**Energy Use/ Green House Gas Contribution:**

Impacts to energy use/GHG contributions under Alternative 5 would be comparable to the Preferred Alternative.

Environmental impacts potentially resulting from the Allens Creek Reservoir alternative are greater for both wetlands and other waters of the U.S. and cultural resources than those associated with the Preferred Alternative.

## Alternative 6 -Seawater Desalination

### Description

Seawater desalination in the Freeport area has been evaluated by various entities over the last fifteen years[4]. Seawater desalination is included in the alternatives analysis due to the continued evaluation of this technology as a method of providing usable water for the facilities at Dow as well as the Freeport area. The capital intensity and high energy cost of desalinating seawater typically make it an alternative of last resort.

[4] The Brazos River Authority conducted a Texas Water Development Board funded feasibility analysis of a desalination project conceptually constructed and operated as a public-private partnership. The 2004 report describes a conceptual project that would be phased in over time. Desalination projects were included in the 2011 Region H Regional Water Plan and the 2016 Region H Regional Water Plan. Yield vary among the projects and information from both the 2011 and 2016 Region H Regional Water Plans was used in this analysis.

The 2016 Region H Regional Water Plan includes an 11,200 acre-feet seawater desalination project to be constructed in the 2040 timeframe. The project would include diversion of seawater using an existing intake facility, a 10 MGD reverse osmosis plant, an existing outfall to discharge brine concentrate into the Gulf of Mexico via the Brazos River and raw water and treated water conveyance facilities.

The 2011 Region H Regional Water Plan included a similar desalination project sized to produce 33,600 acre-feet per year (Region H 2010, TWDB 2016). Information from the initial, larger project as well as the 11,200 acre-foot project studies has been used for this alternatives analysis. Note that to meet the project need, a desalination project would need to be expanded significantly from the representative projects previously studied. Given the limited availability of existing storage to support Dow fresh water rights, a 100+ MGD plant would be needed to meet the approximate 430 acre-foot per day (97,000 gallons per minute) water demands. **Figure D-7** presents the updated location for a potential desalination facility due to the conceptual location of the 10 MGD alternative studied by the Region H Water Planning Group is no longer available. It is assumed for this analysis that the studied plant could be upsized at the proposed location to meet the project need.

## Practicability Factors

The seawater desalination alternative would be able to utilize existing Dow-owned seawater rights however, it does not fully meet the project need due to the storage requirements necessary to be prepared for a drought. It was studied in more detail due to its potential to meet the water supply volume required.

**Logistical Factors:** The plant would need to be sited in proximity to the available seawater with the existing water rights, and the intake design, salty sludge disposal and brine discharges would require authorization by the Texas Commission on Environmental Quality. Hence, it would be more difficult to ensure that a large seawater desalination plant could be operational within five years resulting in a low rating for that factor.

This scenario utilizes an identified Dow-owned property however, the currently identified location for a potential desalination plant would place it in proximity to the seawater intake with existing seawater rights, but would result in greater herbaceous **(**PEM) wetland impacts than the preferred reservoir expansion project. The resulting rating for number of properties needed is high. The distance to the existing treated water conveyance system is estimated at less than 20 miles. For these reasons, the conveyance and available water rights factor were given moderate and high ratings respectively.

**Technology Factors:** Constructing a seawater desalination facility capable of producing approximately 100-140 MGD during limited drought conditions is feasible, but impractical. The size of the facility to meet the project need about 6 percent of the time when the need will occur based on TCEQ's Water Availability Model is not reasonable. The rating for this factor is low. The project is, however, able to be constructed without disruption to the existing water supply system resulting in a high rating for this factor.

**Relative Cost: P**lanning level costs estimates prepared by the Region H Regional Water Planning Group developed for the 11,200 acre-feet per year project indicate that annualized capital and operating costs are calculated to be $2,454 per acre-foot of delivered water (more than 8 times the calculated cost for the preferred alternative) and capital costs would be $11,869 per acre-foot (one-time cost not annualized over time) which is more than 4 times greater than the preferred alternative.

The presented unit cost estimates would be expected to decrease incrementally as the annual yield of the project increases; however, the cost of desalinated seawater would remain significantly higher than the other options. This alternative was given a low rating for the relative cost factors and relative energy consumption.

Available sites for an expanded desalination facility are limited. The location identified for this analysis (Figure D-7) is an available site within the vicinity of accessible seawater. This location has 50 out of 53 acres of herbaceous (PEM) wetlands which would be impacted by the project. Other locations considered to be able to efficiently access coastal water for a desalination project would have considerable wetlands impacts.

*This alternative is not practicable, but could potentially meet the need for the project if upsized; however, the expected development timeframe, extraordinary high costs and capacity required to meet peak delivery requirements during drought conditions which is intermittent and unpredictable would result in uncertainty as to its practicability to meet the project need.*

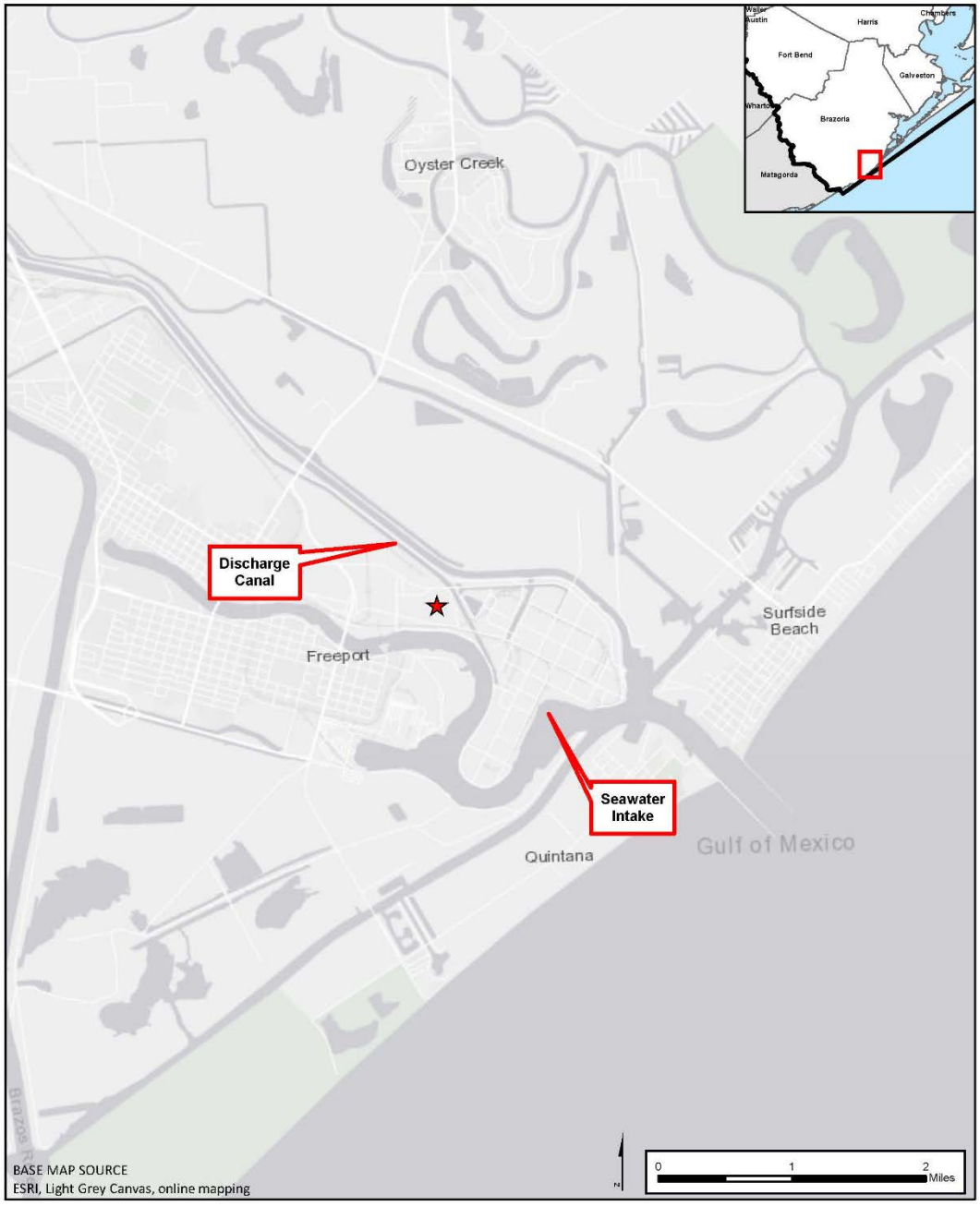



Figure D-7. Seawater Desalination Alternative Location
*Harris Expansion Project Individual Permit Application*

## Consequences

**Threatened and Endangered Species:** Minor impacts to threatened and endangered species would occur as a result of the proposed alternative. The federally-listed hawksbill sea turtle, leatherback sea turtle, green sea turtle, loggerhead sea turtle, and Kemp's Ridley sea turtle have the potential to occur within the proposed project area for Alternative 6. However, the use of existing intake and outfall structures would reduce impacts to sea turtles that may occur during construction of these structures. The treatment facility would be located near the Texas Operations site and would have negligible impacts to terrestrial threatened and endangered species or their habitats.

No designated critical habitat, as defined by the ESA, is in or near the project area. There would be no impacts to critical habitat.

**Water Quality:** Discharged concentrate (brine water) may include water with warm temperature containing residues of pre-treatment and cleaning chemicals, their reaction byproducts, and heavy metals. Moderate impacts to water quality would occur as a result of the discharge of brine water resulting from the treatment process (i.e., concentrate) into the existing waste water canal and ultimately into the Brazos River.

**Wetlands and waters of the U.S.:** The desalination plant would impact approximately 50 acres of potentially jurisdictional wetlands near the Plant A site evaluated. Increasing the footprint of the plant to meet the project need would be expected to increase impacts to wetlands and waters of the U.S. Major impacts to wetlands and waters of the U.S. would occur as a result of the proposed alternative. Additionally, it is likely that the proposed pipeline alignments needed to distribute the treated water throughout the complex and treatment facility would impact wetlands and other waters of the U.S. Therefore, this alternative would have greater impacts than the proposed project.

**Aquatic Habitat:** Moderate impacts to aquatic habitat would occur as a result of the discharge of the concentrate (brine water). The constant discharge of reject streams with high salinity and temperature levels can be fatal for river and marine life and may cause a permanent change in the species composition and abundance at the discharge site. Mitigation measures such as brine water dilution with seawater or cooling water could be implemented to reduce impacts to aquatic habitat at the discharge site. With appropriate management, impacts to aquatic habitat would be minor to moderate.

**Land Resources:** The proposed site is located within a heavily industrialized area that is owned and operated by Dow or other industrial facilities. This alternative would have negligible impacts on land resources.

**Cultural Resources:** The treatment facility is located within a heavily industrialized area and the proposed pipelines would parallel existing alignments whenever possible, reducing the chance of impacting unidentified cultural resource sites. Negligible or minor impacts to cultural resources would occur as a result of the proposed alternative.

**Energy Use/ Green House Gas Contribution:** Energy requirements for seawater desalination average about 15,000 kWh per million gallons of water produced (Brazos River Authority (BRA) 2004. *The Freeport Seawater Desalination Plant Report*)[5]. Through increased energy use for treatment, desalination can cause an increase in GHG emissions. Alternative 6 would have moderate and long-term impacts on energy use and GHG contributions. The alternatives with next highest energy use (Alternatives 2, 3 and 4) are estimated to use 14 percent of the energy of this alternative. Therefore, energy use and greenhouse gas contributions would be substantially higher than those for the Preferred Alternative as well as the other alternatives identified.

[5] Energy requirements for this alternative were extrapolated from the 2004 report for this alternative and include estimated requirements for treatment only. Pumping required for distribution would be greater.

# Comparison of Alternatives Carried Forward

A detailed evaluation of practicability factors is summarized in **Table D-5**. Potential environmental impacts of the alternatives described in this section are summarized in **Table D-6** for the practicable alternatives. The preferred alternative, Harris Expansion Project is the least environmentally damaging practicable alternative based on this analysis.

Table D-5. Evaluation of Alternatives for Practicability
*Harris Expansion Project Individual Permit Application*

| **Alternative**<br>○ = Low<br>◒ = Moderate/ Limited<br>● = High | **No Action (1)** | **Harris Expansion Project (2)** | **Different Embankment Configuration (3)** | **Different Site Location (4)** | **Allens Creek Reservoir (5)** | **Seawater Desalination (6)** |
|---|---|---|---|---|---|---|
| **Overall Project Purpose Factors** | | | | | | |
| Ability to provide reliable water supply for Texas Operations during extended drought (reliable is defined as: 1) available during a drought, and 2) able to deliver supply at rates equal to water demand to Dow and those they serve on a daily/weekly basis) | ○ | ● | ● | ● | ◒ | ● |
| Ability to use existing Dow-owned surface water rights diverted within the authorized diversion segment | ○ | ● | ● | ● | ○ | ● |
| **Logistical Factors** | | | | | | |
| Ability to be operational within 5 years | N/A | ● | ● | ◒ | ○ | ◒ |
| Property rights / # of property owners affected | N/A | ● | ● | ○ | ● | ● |
| Conveyance distance to existing conveyance system (greater distances reduce reliability due to main breaks or evaporation) | N/A | ● | ● | ◒ | ◒ | ○ |
| Water availability/ water right availability to Dow (either new permits or through agreement/ acquisition) | N/A | ● | ● | ● | ○ | ● |
| **Technology Factors** | | | | | | |
| Project capable of high peak delivery rates (e.g., 3000 acre-feet per week) with reasonably-sized capital facilities | N/A | ● | ● | ● | ○ | ○ |
| Project capable of being constructed with existing water supply system (Harris and Brazoria reservoirs) remaining in operation | N/A | ● | ● | ● | ● | ● |

Table D-5. Evaluation of Alternatives for Practicability
*Harris Expansion Project Individual Permit Application*

| **Alternative**<br>○ = Low<br>◒ = Moderate/ Limited<br>● = High | **No Action (1)** | **Harris Expansion Project (2)** | **Different Embankment Configuration (3)** | **Different Site Location (4)** | **Allens Creek Reservoir (5)** | **Seawater Desalination (6)** |
|---|---|---|---|---|---|---|
| **Relative Cost Factors** | | | | | | |
| Annual unit cost per acre-foot per year (annual capital and operations & maintenance) | N/A | ● | ● | ● | ● | ○ |
| Unit capital cost per acre-foot | N/A | ● | ● | ● | ● | ○ |
| Availability of suitable land for project at reasonable cost | N/A | ● | ● | ○ | ● | ● |

Table D-6. Summary of Potential Environmental Consequences
*Harris Expansion Project Individual Permit Application*

| ○ = Low<br>◒ = Moderate/ Limited<br>● = High | **Threatened/ Endangered Species** | **Surface Water Quality** | **Wetlands/ Waters of the U.S.** | **Aquatic Ecosystem** | **Land (subsidence/ non-Dow land)** | **Cultural Resources** | **Energy / GHG** |
|---|---|---|---|---|---|---|---|
| 1 - No Action | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 2 - Harris Expansion Project (Proposed Project) | ○ | ○ | ◒ | ○ | ○ | ◒ | ○ |
| 3 - Harris Expansion Project –Alternate Embankment Configuration | ○ | ○ | ◒ | ○ | ○ | ● | ○ |
| 4 - Harris Expansion Project – Alternate Location | ○ | ○ | ◒ | ○ | ● | ◒● | ○ |
| 5 - Allens Creek Reservoir | ○ | ○ | ● | ◒ | ◒ | ● | ○ |
| 6 – Seawater Desalination | ◒ | ◒ | ● | ◒ | ○ | ○ | ● |

# Alternatives Considered but Eliminated from Further Analysis

The first step for this analysis was to screen out those preliminary alternatives found to be not practicable or that would not meet the project's overall purpose or need. For the purpose of this analysis, practicable is defined as alternatives which can be implemented to meet the project purpose and need after costs, existing technology, and/or logistic factors are considered. Additional considerations are whether the alternative includes a special aquatic site as defined by the Clean Water

Act (CWA). The guidelines cover all waters of the U.S. but afford special aquatic sites a higher level of scrutiny and protection. Special aquatic sites include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and stream riffle and pool complexes. From a national perspective, the degradation or destruction of special aquatic sites is considered among the most severe environmental impacts covered by the guidelines. However, due to the water dependent nature of the proposed project, all the structural alternatives involve a special aquatic site. This screening process resulted in the following 9 alternatives being eliminated from further analysis for the reasons identified in this section and summarized in **Table D-1**.

## Alternative B - Enhanced Conservation

The Enhanced Conservation alternative includes capital projects and operational changes within the Texas Operations site that would reduce water consumption by an additional 10 percent (approximately 20,000 acre-feet) per year. Water potentially saved from such measures is planned to offset future growth in water supply needs should manufacturing at the Texas Operations site increase in the future.

Dow has implemented water-efficiency measures at their facilities resulting in permanent water savings of approximately 20,286 acre-feet per year - an approximate ten percent reduction of their freshwater demand from the Brazoria and Harris Reservoirs. The Texas Commission of Environmental Quality recognized Dow with an Environmental Excellence Award for the water-savings achievements (TCEQ 2016b). Implemented water conservation measures at Texas Operations include implementing more efficient closed loop cycle cooling. Other conservation projects replaced surface water diversions with recycled process water (soft water). These measures have reduced daily water demands but are not sufficient to provide a reliable water supply during drought.

Therefore, while in the near-term, such measures could reduce daily water demand from Dow's existing water supply and storage system, long-term reductions in daily demand would not be expected as a result of implementing the Enhanced Conservation alternative. Additionally, Dow has estimated that reducing its water demand by 33 percent – if possible – would only extend its existing storage by one month (Dow 2014).

*The Enhanced Conservation alternative does not meet the purpose of or need for a reliable water supply for the Texas Operations facilities during extended drought conditions. Therefore, it was not evaluated in detail.*

## Alternative C - Expanded Reclaimed Water Use

The Expanded Reclaimed Water Use alternative includes use of municipal reclaimed water from the cities of Alvin and Freeport delivered via the bed and banks of Oyster Creek or via pipeline to the Texas Operations distribution system. The projected water demand in 2020 for the cities is 4,644 acre-feet and 1,283 acre-feet, respectively (*2016 Region H Regional Water Plan*). Assuming that 70 percent of water used is treated and discharged and available for reuse, up to approximately 4,150 acre-feet per year (80 acre-feet per week) could be available in an Expanded Reclaimed Water Use alternative. This volume is substantially below Dow's weekly water demand of approximately 3,000 acre-feet per week.

*The Expanded Reclaimed Water Use alternative does not create sufficient volume to meet the need for the project. Therefore, it was not evaluated in detail.*

## Alternative D - Utilize Existing Stored Water or Underutilized Run-of River Rights in Brazos River

The "Utilize Stored Water or Underutilized Run-of-River Rights in the Brazos River" alternative includes executing contract (s) with the Brazos River Authority (BRA) to purchase additional stored water from upstream reservoirs and/or supplementing water supply with water rights acquisition or lease from

other water right holders in the basin. An assessment of the surface water rights available for transfer in the Brazos River concluded that in the Brazos River basin, most of the water use is for industrial or municipal purposes, rather than agriculture. Most municipal and industrial water rights would not be available for acquisition by Dow as the water right holders need to maintain their rights for their own current or future needs. Opportunities to lease agricultural water rights or implement agricultural water conservation measures in exchange for downstream diversion by Dow were considered to provide minimal water supply benefits (Reddy, et al. 2015).

*The volume of available water, conveyance losses due to seepage and evaporation and the "junior[6]" status of many of the agricultural rights in the basin result in a project alternative to acquire underutilized surface water rights in the basin not providing a reliable water supply sufficient to meet the purpose of and need for the project. Therefore, it was not evaluated in detail.*

## Alternative E - Modification of Existing Harris Reservoir

The "Modification of Existing Harris Reservoir" alternative includes activities such as dredging, deepening or raising the embankment of the existing Harris Reservoir to expand the storage capacity.

Expanding the storage capacity of the Harris Reservoir was evaluated at a conceptual level. Technical issues related to dam safety were identified during the analysis. It is unlikely that dredging or deepening the reservoir would provide the needed storage capacity. Therefore, modification of the reservoir to expand the storage capacity would not meet the primary purposes of the project. Additionally, the ability to maintain operations of the reservoir to meet water needs at the Texas Operations site during construction poses challenging constructability issues.

*Technical and constructability issues associated with modification of the existing Harris Reservoir render this alternative not practicable. Therefore, it was not evaluated in detail.*

## Alternative F – Modification of Existing Brazoria Reservoir

The "Modification Existing Brazoria Reservoir" alternative includes activities such as dredging, deepening or raising the embankment of the existing Brazoria Reservoir to expand the storage capacity.

Expanding the Brazoria Reservoir, if feasible, would not provide Dow access to low river flows during drought due to the upstream movement of saline water in the lower Brazos basin during low flow conditions (e.g., the salt water wedge in the lower Brazos River). Historically, Dow has had to cease diversions from the Brazos River intake to the Brazoria Reservoir due to the salt water intrusion.

There are technical difficulties related to dam safety in potentially raising the embankment to expand the storage capacity. It is unlikely that dredging or deepening the reservoir would provide the needed storage capacity. Therefore, modification of the reservoir to expand the storage capacity would not meet the primary purposes of the project.

*Salt water intrusion that limits diversions to Brazoria Reservoir during low flow conditions and technical and constructability issues associated with the expansion of the existing Brazoria Reservoir render this alternative not practicable. Therefore, it was not evaluated in detail.*

## Alternative K – Aquifer Storage and Recovery

The "Aquifer Storage and Recovery (ASR)" alternative includes an ASR well field(s) (either 10 MGD or 14 MGD) in central Brazoria County near Brazosport Water Authority water treatment plant and

[6] In Texas, water rights are authorized under the Prior Appropriations Doctrine which means that water rights have priority, or seniority, based on their appropriation date. That is, during times of water shortage, newer, or junior rights, must forego diversion so that senior waters can be satisfied. This makes junior water rights without storage less reliable than senior water rights. Dow's water rights are among the most senior in the Brazos River basin.

conveyance facilities that could be operated to store treated water during low demand months for retrieval and distribution during summer months. This would provide operational flexibility to maintain storage water in the existing Dow water system reservoirs.

In addition to the well field, the alternative would include conveyance facilities to transport water to Oyster Creek from where it would be diverted and conveyed to the Texas Operations distribution system. Potentially, a new water treatment plant or expanding capacity would be required if the existing Brazosport Water Authority plant provides insufficient treatment capacity to support treatment of water prior to injection into the ASR well field (HDR 2013).

The project would not provide sufficient storage nor ASR well recovery capacity to deliver up to 3,000 acre-feet per week. Expanding the wellfield is not practicable due to land availability constraints near the Brazosport Water Authority facilities. Expansion of the water treatment plant to treat peak flows prior to injection to support a larger project are cost prohibitive.

*Additional capital facilities and limited land availability land, and capital and operating cost factors render this alternative not practicable. Therefore, it was not evaluated in detail.*

## Alternative L - Surface Water from Adjacent Basins

The "Surface Water from Adjacent Basins" alternative includes an interbasin transfer of water from the Colorado River to the west or the Trinity River to the east. In Texas, surface water rights that leave the basin of origin via interbasin transfers lose their seniority and become the most junior right at the time that the interbasin transfer is authorized[7]. An interbasin project would require storage in the basin of origin or near the Texas Operations site to provide a firm yield providing a reliable water supply that could deliver water at needed rates during drought conditions.

Surface water in the Colorado River basin is fully appropriated. Additionally, the Lower Colorado River Authority, the largest water right holder in the basin suspended delivery of interruptible water from its main storage reservoirs north of Austin (lakes Buchannan and Travis) to downstream users for three years during 2012-2014. Therefore, water supply from the Colorado River is not anticipated to be available for Dow's use.

Potentially, surface water from the Trinity River basin could be available for acquisition by Dow for use at the Texas Operations through a water purchase agreement from the Trinity River Authority. Based on recent permitting processes and water supply agreements in Texas, acquisition of the required regulatory authorizations (e.g., surface water permit amendments) would take several years, the water supply agreement would likely include a temporary term (i.e., would not be a permanent water source) and construction of a storage reservoir would be required.

*Additional capital facilities, higher energy requirements, limited water availability, water rights constraints, potential impacts to instream flows and freshwater bay and estuary inflows in the basins of origin, costs and regulatory approvals within the timeframe that the project is needed render this alternative not practicable. Therefore, it was not evaluated in detail.*

## Alternative M - Local Groundwater Supply

The "Local Groundwater Supply" alternative includes construction of a wellfield in Brazoria or Matagorda counties to produce groundwater from the Chicot and Evangeline Aquifers and conveyance facilities to transport water to the Texas Operations distribution system (HDR 2013). Groundwater supply in Brazoria County is primarily from the Chicot aquifer. Water level declined during the 1980s and 1990s; however, water levels recovered and stabilized since regulatory measures were established to

7 There are a few water rights in Texas that include the explicit authorization for interbasin transfer without loss of seniority; however, those are not the standard water right.

reduce groundwater pumping to minimize land subsidence in the region. Similarly, groundwater pumping in Matagorda County is also primarily from the Chicot aquifer. Water levels are somewhat stable with declines projected based on estimated annual average pumping increases in the future.

In both Brazoria and Matagorda counties, annual historical pumping has exceeded the volume of Modeled Available Groundwater, an amount of water established by regional groundwater planning groups within Groundwater Management Area 14 established by the state. While groundwater conservation districts with jurisdiction over groundwater can issue production permits in excess of the Modeled Available Groundwater, they also have the authority to reduce permitted production in excess of the Modeled Available Groundwater volume during the life of the project. Such potential reductions in authorized production make this an unreliable water supply option over time (HDR 2013).

*Due to limited volume of permittable groundwater production, uncertainty over future availability of groundwater in Brazoria and Matagorda counties and concerns regarding land subsidence, the Local Groundwater alternative is considered not practicable. Therefore, it was not evaluated in detail.*

## Alternative N – Remote Groundwater Supply

The "Remote Groundwater Supply" alternative includes construction of a wellfield in southeast Wharton County to produce up to 17,500 acre-feet/year of new water supply from the Chicot and Evangeline aquifers in southeast Wharton County. Conveyance to the Texas Operations distribution system would be accomplished via a 26-mile transmission pipeline to the Brazos River where the water would be conveyed via the bed and banks of the river to Dow's existing diversion facilities from where it would be diverted and conveyed to the Texas Operations distribution system (HDR 2013).

In Wharton County, annual historical pumping has exceeded the volume of Modeled Available Groundwater, an amount of water established by regional groundwater planning groups within Groundwater Management Area 14 established by the state. Assessment of historical pumping, changes in groundwater levels resulting from pumping and regulatory constraints were factors used in developing the project yield. It is unlikely that a wellfield designed to meet the peak capacity needed to meet needs at the Texas Operations site would be permitted. While the Coastal Bend Groundwater Conservation District, the political subdivision with jurisdiction over groundwater production in Wharton County has the authority to issue production permits in excess of the Modeled Available Groundwater volume, it also has the authority to reduce permitted production in excess of the Modeled Available Groundwater volume during the life of the project. Such potential reductions in authorized production make this an unreliable water supply option over time (HDR 2013).

*Due to limited volume of permittable groundwater production, uncertainty over future availability of groundwater in Wharton County and the additional land resources needed to develop an approximate 50,000 acre-foot project with the ability to delivery approximately 3,000 acre-feet per week during drought conditions, the Remote Groundwater Supply alternative is deemed to not meet the purpose and need for the project and is considered not practicable. Therefore, it was not evaluated in detail.*

## Alternative P - Lake Somerville Augmentation

The "Lake Somerville Augmentation" alternative includes construction of a pump station and pipeline to deliver high flows from the Brazos River to increase the firm yield up to an additional 22,800 acre-feet per year in the existing Lake Somerville located in Burleson, Lee and Washington counties (*2016 Region H Regional Water Plan*). The alternative would include buying water released from Lake Somerville from the Brazos River Authority, if available. Stored water releases would be conveyed via the bed and banks of the Brazos River to Dow's existing diversion facilities and delivered to the Texas Operations water distribution system. Because Lake Somerville is owned by the U.S. Army Corps of Engineers (although the water rights are owned by the Brazos River Authority), coordination and permitting would be required to implement this alternative. The project is conceptually identified for implementation

sometime between 2020 and 2030; additional supply may not be available by 2021 to meet the need for the project.

Some estimates indicate that a range of 15 to 30 percent of water released from the central Brazos River basin would be lost to seepage and evaporation, leaving a range of 15,960 – 19,380 acre-feet per year available for diversion for Dow – assuming they had access to all the supply created through this alternative. The Brazos River Authority and the Region H Regional Water Plan project increased water demands in the central basin due to population growth in the area, so it is unlikely that this supply would be available for Dow at the delivery quantities needed to maintain supply at the Texas Operations.

*Due to uncertainty regarding availability of the supply, implementation schedule and the project's inability to meet Dow's water delivery needed, this is not a practicable alternative to meet the purpose of and need for the project. Therefore, it was not evaluated in detail.*

# Preliminary Public Interest Review Screening

The ultimate decision by the USACE as to whether to issue a permit will be based on an evaluation of the probable impacts of the proposed activity and its intended use on the public interest. The public interest review requires the careful weighing of expected benefits balanced against reasonably foreseeable detriments. Thus, one specific factor (e.g., fish and wildlife values or economics) cannot by itself force a specific decision, but rather the decision represents the net effect of balancing all public interest factors, many of which are frequently in conflict. 33 CFR Part 320, General Regulatory Policies, direct the USACE to consider the following general criteria in the evaluation:

i. The relative extent of the public and private need for the proposed structure or work:

ii. Where there are unresolved conflicts as to resource use, the practicability of using reasonable alternative locations and methods to accomplish the objective of the proposed structure or work; and

iii. The extent and permanence of the beneficial and/or detrimental effects which the proposed structure or work is likely to have on the public and private uses to which the area is suited (33 CFR Part 320.4).

While recognizing that the USACE will further evaluate (and consult with other federal agencies during the permit review process to assess the overall benefits or detriment for some public interest factors, as a committed community partner within the Brazoria County area, Dow prepared a preliminary assessment of the alternative projects' consistency with public interest criteria as part of its evaluation of alternative projects. **Table D-7** provides a preliminary evaluation in which comparisons of public interest benefits versus detriments are framed with "yes" and "no" determinations with "yes" meaning public interest benefits accrued outweigh or are reasonably balanced against foreseeable detriments, and "no" meaning benefits accrued do not outweigh or are not reasonably balanced against foreseeable detriments (USACE 2014). Some factors may not be applicable for some alternatives and are so noted (GPO 2012).

Table D-7. Preliminary Public Interest Review Screening
*Harris Expansion Project Individual Permit Application*

| Public Interest Category | Description | Alternative 1<br>No Action | Alternative 2<br>Harris Expansion Project | Alternative 3<br>Harris Expansion Project – Alternate Embankment Configuration | Alternative 4<br>Harris Expansion Project – Alternate Location | Alternative 5<br>Allens Creek Reservoir | Alternative 6<br>Seawater Desalination |
|---|---|---|---|---|---|---|---|
| Conservation | Evaluated on benefit or detriment to existing, proposed, or potential future conservation lands. | N/A | Yes | Yes | Yes | Yes | Yes |
| Economics | Evaluated on the economic benefits important to the local community and whether needed improvements in the local economic base are contributed, affecting such factors as employment, tax revenues, community cohesion, community services, and property values. | No | Yes | Yes | Yes | Yes | Yes |
| Aesthetics | Evaluated on level of improvement or disturbance to existing visual amenities. | N/A | Yes | Yes | Yes | Yes | Yes |
| General environmental concerns | Evaluated on the result in beneficial effects or detriments to the quality of the environment. | N/A | Yes | Yes | Yes | Yes | Yes |
| Wetlands | Wetlands are a productive, valuable public resource which serve significant biological functions, serve as resources for study of aquatic environments and sanctuaries, shield other areas from wave action, erosion, and storm damage, and store storm and flood waters. Wetlands are ground water discharge areas that maintain minimum base flows and are important to aquatic habitat, and serve water purification functions. The alteration or destruction of wetlands can affect natural drainage, sedimentation patterns, salinity distribution, flushing and other environmental characteristics. Evaluated on overall impact on the values and benefits of wetlands listed. | N/A | Yes | Yes | Yes | Yes | Yes |
| Historic properties | Full evaluation of the general public interest requires that due consideration be given to the effect which the proposed structure or activity may have on values such as those associated with wild and scenic rivers, historic properties and National Landmarks, National Rivers, National Wilderness Areas, National Seashores, National Recreation Areas, National Lakeshores, National Parks, National Monuments, estuarine and marine sanctuaries, archeological resources, including Indian religious or cultural sites, and such other areas as may be established under federal or state law for similar and related purposes. | N/A | Yes | No | Yes | Yes | Yes |
| Fish and wildlife values | Evaluated on the conservation of wildlife resources by prevention of their direct and indirect loss and damage. | N/A | Yes | Yes | Yes | Yes | Yes |
| Flood hazards | Evaluated on the avoidance of floodplain development and if there are no practicable alternatives, which avoid floodplain development, whether any significant adverse impact to the floodplain can be effectively mitigated. | N/A | Yes | Yes | Yes | Yes | Yes |
| Floodplain values | Evaluated on long and short term significant adverse impacts associated with the occupancy and modification of floodplains, as well as the direct and indirect support of floodplain development whenever there is a practicable alternative. | N/A | Yes | Yes | Yes | Yes | Yes |
| Land use | Evaluated on whether changes to existing zoning or other land use controls are required and whether there is encroachment on adjacent incompatible land uses. | N/A | Yes | Yes | Yes | Yes | Yes |
| Navigation | Navigable waters of the United States are those waters of the United States that are subject to the ebb and flow of the tide shoreward to the mean high water line and/or those waters that are presently used, or have been used in the past or may be susceptible to use for interstate or foreign commerce. These are waters that are navigable in the traditional sense. Permits are required in these waters pursuant to Section 10 of the Rivers and Harbors Act. | N/A | Yes | Yes | Yes | Yes | Yes |
| Shore erosion and accretion | Evaluated on potential to widen or narrow of waters of the US and the benefits or detriments to human use and aquatic habitat resulting from these changes. | N/A | Yes | Yes | Yes | Yes | Yes |

Table D-7. Preliminary Public Interest Review Screening
*Harris Expansion Project Individual Permit Application*

| Public Interest Category | Description | Alternative 1<br>No Action | Alternative 2<br>Harris Expansion Project | Alternative 3<br>Harris Expansion Project – Alternate Embankment Configuration | Alternative 4<br>Harris Expansion Project – Alternate Location | Alternative 5<br>Allens Creek Reservoir | Alternative 6<br>Seawater Desalination |
|---|---|---|---|---|---|---|---|
| Recreation | Existing natural resources, such as wild and scenic rivers, can have significant recreational value, which is important to the general public interests, and both potentially negative and positive effects on overall recreational value. The values of recreational benefits are evaluated on overall potential changes to current recreational opportunities. | N/A | N/A | N/A | N/A | N/A | N/A |
| Water supply and conservation | Water conservation requires the efficient use of water resources in all actions which involve the significant use of water or that significantly affect the availability of water for alternative uses including opportunities to reduce demand and improve efficiency to minimize new supply requirements. Actions affecting water quantities are subject to Congressional policy as stated in section 101(g) of the Clean Water Act which provides that the authority of states to allocate water quantities shall not be superseded, abrogated, or otherwise impaired. | No | Yes | Yes | Yes | Yes | Yes |
| Water quality | Evaluated for compliance with applicable effluent limitations and water quality standards, during the construction and subsequent operation of the proposed activity. It should be noted, however, that the Clean Water Act assigns responsibility for control of non-point sources of pollution to the states. Certification of compliance with applicable effluent limitations and water quality standards required under provisions of section 401 of the Clean Water Act will be considered conclusive with respect to water quality considerations unless the Regional Administrator, Environmental Protection Agency (EPA), advises of other water quality aspects to be taken into consideration. | N/A | Yes | Yes | Yes | Yes | Yes |
| Energy needs | Energy conservation and development are major national objectives. Evaluated based on energy requirements, potential for conservation and development with high priority to alternatives involving energy projects. | N/A | Yes | Yes | Yes | Yes | No |
| Safety | Evaluated on overall risks for human health and/or the creation of unsafe conditions for those with access. | N/A | Yes | Yes | Yes | Yes | Yes |
| Food and fiber production | Evaluated on the degree of impact on existing and potential food and fiber production properties. | N/A | Yes | Yes | Yes | Yes | Yes |
| Mineral needs | Evaluated on the benefits or detriment to existing or potential future mineral production. | N/A | N/A | N/A | N/A | N/A | N/A |
| Considerations of property ownership | Evaluated on whether the property is available and can be used for the project purpose without disproportionately impeding on the rights for private land use, the general right to protect property from erosion, and riparian landowners general right of access to navigable waters of the US. | N/A | Yes | Yes | Yes | Yes | Yes |
| Needs and welfare of the people | Evaluated on overall benefit or detriment to current and future population of Brazoria County. | No | Yes | Yes | Yes | Yes | Yes |

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