# City of New Braunfels
# 2020 EAHCP Work Plan

## 2020 City of New Braunfels Work Plan Budget

| EAHCP Section | Conservation Measure | Table 7.1 | Available Budget for 2020 | Estimated 2020 Budget | Delta Between Available and Estimated |
|---|---|---|---|---|---|
| 5.2.1 | Flow Split Management | $0 | $0 | $0 | - |
| 5.2.2.1/ 5.2.2.3 | Old Channel Aquatic Vegetation Restoration & Maintenance | $100,000 | $100,000[a] | $50,000 | $50,000 |
| 5.2.2.2/ 5.2.2.3 | Landa Lake/ Comal River Aquatic Vegetation Restoration & Maintenance | $50,000 | $50,000 | $100,000 | ($50,000)[a] |
| 5.2.3 | Management of Public Recreation | $0 | $0 | $0 | $0 |
| 5.2.4 | Decaying Vegetation Removal and Dissolved Oxygen Management | $15,000 | $15,000 | $15,000[b] | $0 |
| 5.2.5/5.2.9 | Non-Native Animal Species Control | $75,000 | $75,000 | $50,000 | $25,000[e] |
| 5.2.6/ 6.3.6 | Monitoring and Reduction of Gill Parasites | $75,000 | $75,000 | $10,000[b] | $65,000[c,d] |
| 5.2.7 | Prohibition of Hazardous Material Transport Routes | $0 | $0 | $0 | $0 |
| 5.2.8 | Native Riparian Habitat Restoration (Riffle Beetle) | $25,000 | $25,000 | $10,000 | $15,000[c] |
| 5.2.10 | Litter and Floating Vegetation Management | $0 | $0 | $30,000 | ($30,000)[c] |
| 5.2.11 | Golf Course Management | $0 | $0 | $0 | $0 |
| 5.7.1 | Native Riparian Habitat Restoration | $100,000 | $75,000 | $125,000 | ($50,000)[d] |
| 5.7.5 | Management of Household Hazardous Waste | $30,000 | $30,000 | $38,000 | ($8,000)[e] |
| 5.7.6 | Impervious Cover/ Water Quality Protection | $100,000 | $100,000 | $100,000 | $0 |
| | **Totals** | **$570,000** | **$545,000** | **$528,000** | **$17,000** |

a The $50,000 increase in the estimated budget for Task 5.2.2.2 is offset by the $50,000 decrease for Task 5.2.2.1.
b Funds for these measures will be expended only if low-flow conditions (<100 cfs) are realized at Comal Springs.
c Funds from Task 5.2.6 ($15,000) and Task 5.2.8 ($15,000) will be reallocated to fund Task 5.2.10.
d Funds from Task 5.2.6 ($50,000) will be reallocated to fund a portion of Task 5.7.1.
e Funds from Task 5.2.5 ($8,000) will be reallocated to fund a portion of Task 5.7.5.

### 5.2.1 Flow Split Management

**Long-term Objective:**
To sustain flow rates in the Old Channel of the Comal River that compliment Old Channel aquatic vegetation restoration efforts, minimize channel scouring, and maximize the quality of fountain darter habitat.

**Target for 2020:**
Maintain flow rates in the Old and New Channels of the Comal River to meet objectives specified in the revised Table 5-3 of the EAHCP (**Table 1**).

Priority will be given to achieving target flow rates in the Old Channel and, secondly, to flow rates in the New Channel. City of New Braunfels staff will monitor streamflow conditions via USGS streamflow gages and operate the flow-control gate between Landa Lake and the Old Channel to achieve flow targets. Maintenance activities associated with the flow-control gates will be conducted as needed to ensure continued operability.

**Table 1.** EAHCP Table 5-3 (revised)

| Total Comal Springflow (cfs) | Old Channel (cfs) | | New Channel (cfs) | |
|---|---|---|---|---|
| | Fall, Winter | Spring, Summer | Fall, Winter | Spring, Summer |
| 350+ | 65 | 60 | 280+ | 290+ |
| 300 | 65 | 60 | 235 | 240 |
| 250 | 60 | 55 | 190 | 195 |
| 200 | 60 | 55 | 140 | 145 |
| 150 | 55 | | 95 | |
| 100 | 50 | | 50 | |
| 80 | 45 | | 35 | |
| 70 | 40 | | 30 | |
| 60 | 35-40 | | 25 | |
| 50 | 35-40 | | 15 | |
| 40 | 30 | | 10 | |
| 30 | 20 | | 10 | |

**Methodology:**
The City of New Braunfels will manage the flow-split program according to flow rates specified in revised Table 5-3. A standard operating procedure has been developed by the City of New Braunfels to guide adjustments to the flow-control gate and to achieve flow-split targets. City of New Braunfels staff will monitor real-time streamflow conditions at USGS gages in the Comal River system and adjust the flow-control gates, as needed, to meet flow-split streamflow targets. The primary 48" culvert gate and the new back-up culvert gates will be operated conjunctively to meet target flow rates. Floating vegetation and debris will be manually removed from the control gate and screen from a canoe or boat. Vegetative material removed from the intake structure will be placed along the banks of Landa Lake and/ or returned to Landa Lake. Floating vegetation is managed and funded under task of 5.2.10: Litter and Floating Vegetation Management. The flow control gate will be exercised routinely to maintain functionality of the gate.

**Monitoring:**
Flow rates in the Old Channel, New Channel, and Comal River will be based on real-time streamflow data provided by the USGS gages in the Comal River. City of New Braunfels staff will monitor streamflow on a weekly basis, at minimum. Adjustments to the flow-control gate will be made on an as-needed basis to meet flow-spilt management objectives. City of New Braunfels staff will monitor the flow-control gate and intake screen on a regular basis to assess for vegetation build-up and debris that have the potential to restrict flow into the culvert between Landa Lake and the Old Channel. When required, trash racks and vegetation barrier booms will be cleaned to prevent accumulations of vegetation and debris. Accumulated vegetation will be placed along the banks of Landa Lake and/ or returned to Landa Lake.

**Budget:**
Table 7.1:
$0

Available budget:
$0

Estimated 2020 budget:
$0

### 5.2.2.1/ 5.2.2.3 Old Channel Aquatic Vegetation Restoration and Maintenance

**Long-term Objective:**
To achieve native aquatic vegetation coverage goals for the Old Channel Long-Term Biological Goal (LTBG) reach and the Old Channel Environmental Restoration & Protection Area (ERPA) reach as set forth in the revised EAHCP tables 4.1 and 4.1.1, respectively. The overall intent of the native aquatic vegetation restoration program is to provide and increase coverage of high quality habitat for the fountain darter.

**Target for 2020:**

Efforts in 2020 will include the planting of target native aquatic vegetation to achieve annual aquatic vegetation restoration goals and to maintain existing target aquatic vegetation coverage. **Figure 1** illustrates the Comal River system and identifies the individual Old Channel restoration reaches. The 2020 annual aquatic plant restoration goals, as well as the EAHCP long-term aquatic vegetation coverage goals, for the Old Channel LTBG reach and the Old Channel ERPA are specified by reach and vegetation type in **Table 2**. Continued efforts will also be made in 2020 to remove re-emergent non-native *Hygrophila* from the Old Channel LTBG reach and the Old Channel ERPA.

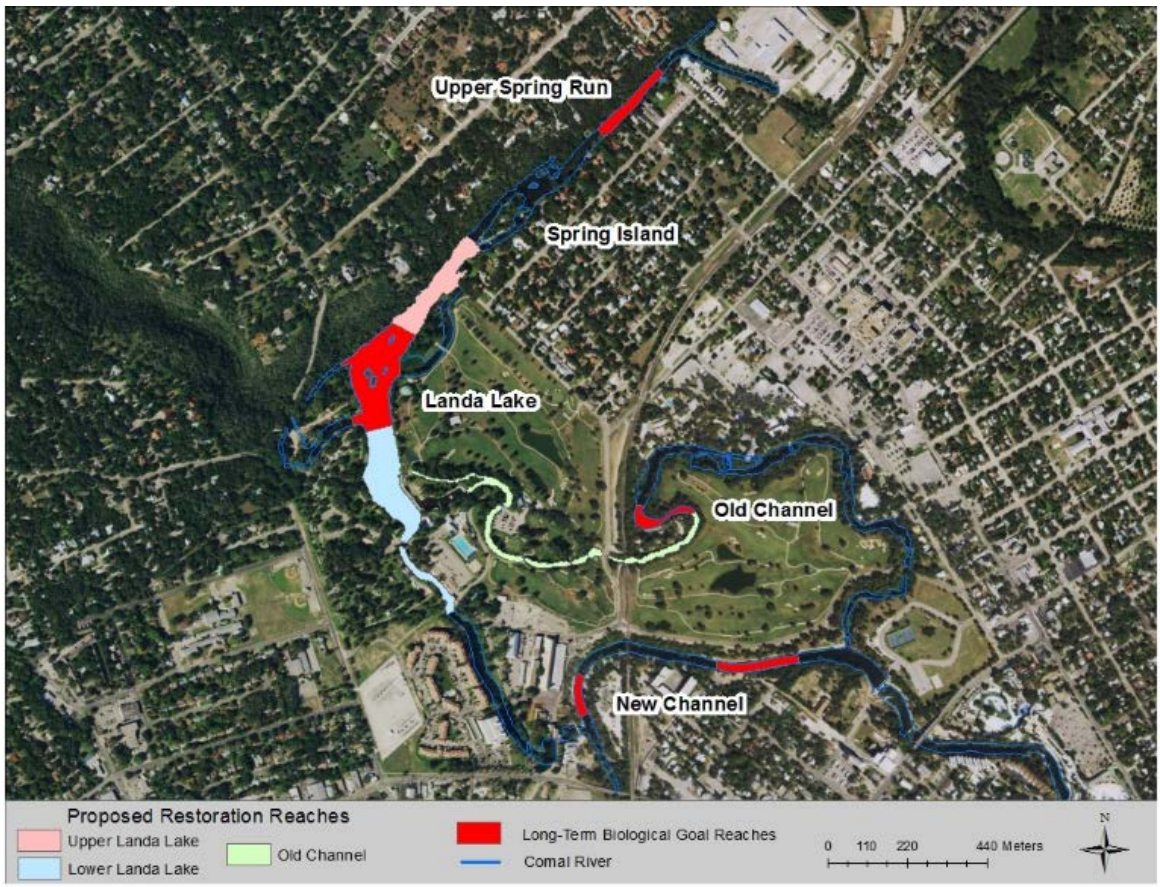


**Figure 1:** Long-term biological goal reaches and restoration reaches for the Comal System. The Old Channel ERPA restoration reach is shown in green. The Old Channel LTBG reach is shown in red.

**Table 2:** Annual and long-term aquatic vegetation restoration goals, in meters squared ($m^2$), within Old Channel LTBG & ERPA restoration reaches.

| Reach | Aquatic Vegetation Species | Meters squared of aquatic vegetation ($m^2$) | Annual Restoration Goal | Approximate # of plantings needed to meet annual goal |
|---|---|---|---|---|
| | | Long-term Goal | 2020 | 2020 |
| **LTBG Reaches** | | | | |
| Old Channel | *Ludwigia* | 425 | 75 | 1,125-1,500 |
| | *Cabomba* | 180 | 25 | 500 |
| | *Sagittaria* | 450 | 50* | 600 |
| **Restoration Reaches** | | | | |
| Old Channel ERPA | *Ludwigia* | 850 | 0** | - |
| | *Cabomba* | 200 | 0** | - |
| | *Sagittaria* | 750 | 0 | - |
| | *Vallisneria* | 750 | 0 | - |
| | *Potamogeton* | 100 | 0 | - |

**Sagittaria* coverage will be monitored and planting will be given low priority given its propensity to naturally expand.

**Supplemental plantings of *Ludwigia* and *Cabomba* will be planted in existing restoration plots in the Old Channel ERPA, as necessary, to maintain existing coverage and/ or to replace any drastic losses in coverage due to floods, natural competition or other factors.

**Methodology:**

*Non-Native Vegetation Management:*

Non-native aquatic vegetation (i.e. *Hygrophila*) has largely been removed from the Old Channel between Landa Lake and the downstream boundary of the Old Channel LTBG reach. Aquatic vegetation gardening will occur on a monthly basis in areas where non-native vegetation has previously been removed in order to identify and remove re-emergent non-native submerged aquatic vegetation (SAV). Small, localized growth of non-native SAV will be removed by selective physical extraction of visible plant and root mass.

*Native SAV Restoration:*

Target SAV species will be planted within the Old Channel LTBG reach to increase the coverage of individual aquatic plant species per the annual restoration goals set forth in **Table 2**. An approximate number of plants needed to achieve the annual goals is also included in **Table 2**. Individual plant species will be planted where planting space is available and in locations within the channel where light exposure, flow velocities, and substrate provide the most suitable conditions for the individual plant types. There are no annual restoration goals set forth for the Old Channel ERPA in 2020. Supplemental plantings of *Ludwigia* and *Cabomba* will be planted in existing restoration plots in the Old Channel LTBG and ERPA reaches, as necessary, to maintain existing coverage and/ or to replace any losses in coverage due to floods, natural competition or other factors.

*Ludwigia* will continue to be propagated in-situ within Landa Lake to provide plant stock for 2020 restoration efforts. In-situ propagation of *Ludwigia* will be conducted by collecting stem cuttings from *Ludwigia* plants present within the Comal River system. The cuttings will be placed in pots filled with substrate collected from within the Comal River system. The potted cuttings are then

placed in Mobile Underwater Plant Propagation Trays (MUPPTs) that will be situated in a shallow portion of Landa Lake and allowed to produce roots and plant mass.

*Ludwigia* plants propagated in the MUPPTs, as well as *Ludwigia* cuttings, will be planted in suitable locations within the Old Channel LTBG reach to achieve an annual target of 75 $m^2$ of additional *Ludwigia* coverage. Slightly more than the targeted coverage of *Ludwigia* will be planted in order to account for plant die-off. Approximately 15-20 *Ludwigia* plants are needed to achieve $1m^2$ of coverage. Therefore, approximately 1,125-1,500 *Ludwigia* plants will be planted in the Old Channel LTBG reach to achieve target annual coverage. Supplemental plantings of *Ludwigia* will be planted within existing restoration plots within the Old Channel ERPA, as needed, to maintain existing coverage of *Ludwigia*.

*Cabomba* typically thrives in deep, low-velocity areas and will be planted in the most suitable locations in the Old Channel LTBG reach to achieve an annual target of 25 $m^2$ of additional *Cabomba* coverage. *Cabomba* will be planted using stem cuttings and/ or with individual rooted plants. Stemmed cuttings will be collected from the New Channel and/ or the Spring-fed pool where *Cabomba* is abundant. The cuttings will be bundled into fist-sized bundles wrapped with rubber bands to keep bundles together. The *Cabomba* cutting bundles are typically 12 to 32 inches in length and will be planted at a depth of 2/3 their length, if possible, in soft, silty sediment. This planting depth prevents *Cabomba* from loosening and floating away and ensures multiple nodes are buried to encourage maximum development of root structure. Rooted *Cabomba* will also be utilized for planting. Rooted plants will be dug up individually from areas where *Cabomba* is abundant. The rooted plants will then be planted individually into silty streambed substrate. Both the stemmed cuttings and rooted plants will be planted in a grid-pattern at 1ft centers. Significantly more than the targeted coverage of *Cabomba* will be planted in order to account for plant die-off. Approximately 20 *Cabomba* plantings are needed to achieve $1m^2$ of coverage. Therefore, approximately 500 *Cabomba* plants will be planted in the Old Channel LTBG reach. Supplemental plantings of *Cabomba* will be planted within existing restoration plots within the Old Channel ERPA, as needed, to maintain existing coverage of *Cabomba*.

*Sagittaria* coverage will be monitored throughout the year to determine the extent of natural expansion and whether planting to increase coverage is required. *Sagittaria* will be planted, as needed, in the most suitable locations in the Old Channel LTBG reach to achieve an annual target of 50 $m^2$ of additional *Sagittaria* coverage at full grow out. *Sagittaria* will be planted as transplants harvested from Landa Lake and other areas where dense *Sagittaria* stands exist. The leaves of the transplants will be trimmed prior to planting to decrease buoyancy and drag. A few *Sagittaria* plants can form a dense colony within several months. *Sagittaria* has been observed to be slightly tolerant of lower light levels allowing it to be planted in deeper water and in shady locations. Approximately 12 *Sagittaria* plants are needed to achieve $1m^2$ of coverage. Therefore, approximately 600 *Sagittaria* plants will be planted in the Old Channel LTBG reach, as needed, to achieve target annual coverage.

Competition between native plants has been observed in the Old Channel where *Potamogeton* and *Sagittaria* have encroached on and taken over *Ludwigia* and *Cabomba* stands. To minimize the effects of competition and to promote the growth and spread of *Ludwigia* and *Cabomba*, buffers will be created around planted *Ludwigia* and *Cabomba* stands to the extent practicable. Any plant material that is removed during this activity will be collected and removed from the lake/ river. Priority will be given first to planting *Ludwigia* and *Cabomba* in areas that are expected to have minimal competition impact on these species.

Following planting of native SAV, monthly gardening and maintenance will occur between March and October to assess health of plants and to identify and remove any non-native vegetation that is beginning to establish within planting areas.

**Monitoring:**
As discussed in previous sections, areas where non-native vegetation removal has occurred will be routinely monitored for the re-establishment of non-native vegetation. Planted areas will also be monitored to assess expansion, die-off, and competition by non-native species. Once native aquatic vegetation is established in an area, monitoring will be conducted on a less frequent basis.

Vegetation mapping in both the Old Channel LTBG reach and the Old Channel ERPA will be conducted to evaluate SAV coverage and to assess the progress of aquatic vegetation restoration efforts. Mapping will occur in January, April, and October. The October mapping event will be used as a basis for assessing overall SAV coverage with respect to meeting long-term vegetation goals and developing annual restoration goals for 2021 and subsequent years.

**Budget:**
Table 7.1:
$100,000

Available budget:
$100,000

Estimated 2020 budget:
$50,000*

*The decrease of $50,000 in the budget for this task will be utilized for Task 5.2.2.2: Comal River/ Landa Lake Aquatic Vegetation Restoration.

### 5.2.2.2/5.2.2.3 Comal River/ Landa Lake Aquatic Vegetation Restoration and Maintenance

**Long-term Objective:**
To achieve native aquatic vegetation coverage goals for the Landa Lake, New Channel, and Upper Spring Run LTBG reaches and the Upper/ Lower Landa Lake restoration reaches as set forth in revised EAHCP tables 4.1 and 4.1.1, respectively. The overall intent of native aquatic vegetation plant restoration is to provide high quality habitat for the fountain darter.

**Target for 2020:**
Efforts in 2020 will include the planting of target native aquatic vegetation to achieve annual aquatic vegetation restoration goals and to maintain existing aquatic vegetation coverage. **Figure 2** illustrates the Comal Springs/ River ecosystem and identifies the Landa Lake, New Channel and Upper Spring Run LTBG reaches as well as the Upper/ Lower Landa Lake restoration reaches. The annual aquatic plant restoration goals for the Landa Lake, New Channel, and Upper Spring Run LTBG reaches and the Upper/ Lower Landa Lake restoration reaches are specified by reach and vegetation type in **Table 3**. In addition to planting the target native aquatic plants to meet annual goals, continued efforts will be made in 2020 to monitor for the re-establishment of non-native *Hygrophila* in Landa Lake, New Channel, and Upper Spring Run LTBG reaches and the Upper/ Lower Landa Lake restoration reaches. Any identified *Hygrophila* will be removed from the lake/ river.

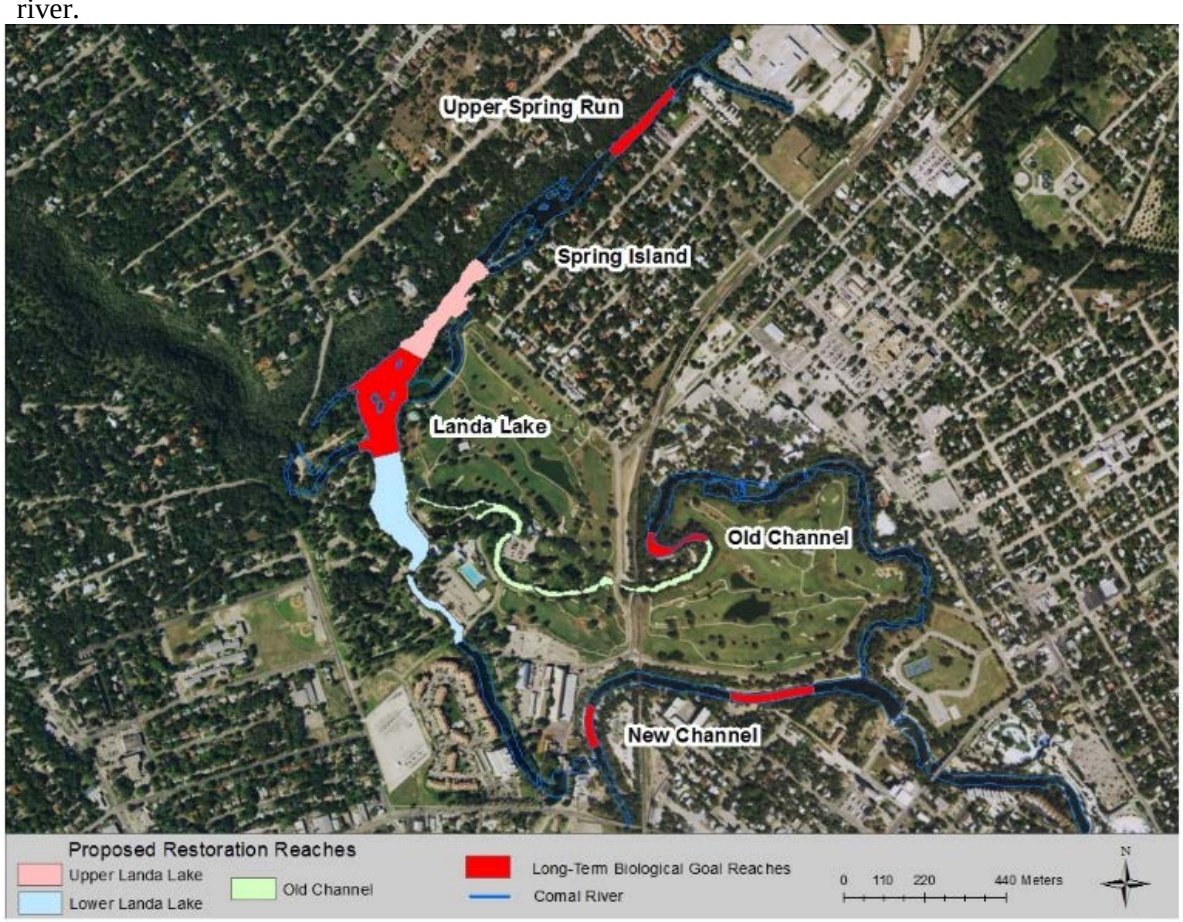


**Figure 2:** Long-term biological goal reaches and restoration reaches for the Comal System. The Upper and Lower Landa Lake restoration reaches are shown in light red and blue (respectively). The Landa Lake, New Channel, and Upper Spring Run LTBG reaches are shown in red.

**Table 3:** Annual and long-term aquatic vegetation restoration goals, in meters squared ($m^2$), within Landa Lake, New Channel, and Upper Spring Run LTBG reaches and Upper/ Lower Landa Lake restoration reaches.

| Reach | Aquatic Vegetation Species | Meters squared of aquatic vegetation ($m^2$) | Annual Restoration Goal | Approximate # of plants needed to meet annual goal |
|---|---|---|---|---|
| | | Long-term Goal | 2020 | 2020 |
| **LTBG Reaches** | | | | |
| Landa Lake | *Ludwigia* | 900 | 105 | 1,575-2,100 |
| | *Cabomba* | 500 | 30 | 600 |
| | *Sagittaria* | 2,250 | 0 | 0 |
| | *Vallisneria* | 12,500 | 75 | * |
| | *Potamogeton* | 25 | 5 | 30 |
| New Channel | *Ludwigia* | 100 | 15 | 225-300 |
| | *Cabomba* | 2,500 | 20 | 400 |
| | *Sagittaria* | 0 | 0 | 0 |
| Upper Spring Run | *Ludwigia* | 25 | 5 | 75-100 |
| | *Cabomba* | 25 | 5 | 100 |
| | *Sagittaria* | 850 | 5** | 60 |
| **Restoration Reaches** | | | | |
| Landa Lake Upper | *Ludwigia* | 25 | 0 | 0 |
| | *Cabomba* | 250 | 35 | 700 |
| | *Sagittaria* | 250 | 50** | 600 |
| Landa Lake Lower | *Ludwigia* | 50 | 10 | 150-200 |
| | *Cabomba* | 125 | 10** | 200 |
| | *Sagittaria* | 100 | 25** | 1200 |
| | *Potamogeton* | 22,500 | - | - |

**Vallisneria* will not be planted but will be allowed to naturally expand, as needed, to increase coverage.
**Based on previous mapping of SAV, coverages exceed the long-term coverage goal. SAV coverages based on Fall 2018 mapping will be used as a benchmark to determine if aerial coverage has fallen short of the long-term goals and whether planting will need to occur.

**Methodology:**

*Non-Native Vegetation Management:*

Non-native aquatic vegetation (i.e. *Hygrophila*) will be removed, as needed, to minimize competition with native submerged aquatic vegetation (SAV). Large-scale removal of non-native SAV is not expected to occur in 2020 as non-native SAV has largely been eliminated from Landa Lake and the Upper Spring Run area. Restoration areas will be monitored for the re-establishment of non-native SAV. Small, localized growth of non-native SAV will be removed by selective physical extraction of visible plant and root mass.

*Native SAV Restoration:*

Target SAV species will be planted within the Landa Lake, New Channel, and Upper Spring Run LTBG reaches to increase the coverage of individual plant species per the annual restoration goals set forth in **Table 3**. An approximate number of plants needed to achieve the annual goals is also included in **Table 3**. Individual plant species will be planted in locations within the channel where light exposure, flow velocities, and substrate provide the best conditions for the individual plant types. Supplemental plantings of *Ludwigia* and *Cabomba* will be planted in existing restoration

plots within the Landa Lake, New Channel, and Upper Spring Run LTBG reaches, as necessary, to maintain existing coverage or to replace any drastic losses in coverage due to floods, natural competition or other factors.

*Ludwigia* will continue to be propagated in-situ within Landa Lake in order to provide plant stock for 2020 restoration efforts. In-situ propagation of *Ludwigia* will be conducted by collecting stem cuttings from *Ludwigia* plants that exist within the Comal River system. The cuttings will be placed in pots filled with substrate collected from within the Comal River system. The potted cuttings will then be placed in Mobile Underwater Plant Propagation Trays (MUPPTs) and placed in a shallow portion of Landa Lake and allowed to produce roots and plant mass. *Ludwigia* plants propagated in the MUPPTs, as well as *Ludwigia* cuttings, will be planted in suitable locations within the Landa Lake LTBG reach to achieve an annual target of 105 $m^2$ of additional *Ludwigia* coverage at full grow out, within the New Channel LTBG reach to achieve an annual target of 15 $m^2$ of additional *Ludwigia* coverage at full grow out, and within the Upper Spring Run LTBG reach to achieve and annual target of 5 $m^2$ of additional *Ludwigia* coverage at full grow out. *Ludwigia* plants and cuttings will also be planted in suitable locations within Lower Landa Lake restoration reach to achieve an annual target of 10 $m^2$ of additional *Ludwigia* coverage. Slightly more than the targeted coverage of *Ludwigia* will be planted to account for plant die-off. Based on previous restoration experience, approximately 15-20 *Ludwigia* plants are needed to achieve 1$m^2$ of coverage. Therefore, approximately 1,575-2,100, 225-300, and 75-100 *Ludwigia* plants will be planted in the Landa Lake LTBG, New Channel LTBG, and the Upper Spring Run LTBG reaches, respectively, to achieve target annual coverage in each reach. Approximately 150-200 *Ludwigia* plants will be planted in the Lower Landa Lake restoration reach to achieve target annual coverage in that reach.

*Cabomba* typically thrives in deep, low-velocity areas and will be planted in the most suitable locations in the Landa Lake LTBG reach to achieve an annual target of 30 $m^2$ of additional *Cabomba* coverage at full grow out, within the New Channel LTBG reach to achieve an annual target of 20 $m^2$ of additional *Cabomba* coverage at full grow out and within the Upper Spring Run LTBG reach to achieve an additional 5 $m^2$ of *Cabomba* coverage at full grow out. *Cabomba* will also be planted in suitable locations within the Upper and Lower Landa Lake restoration reaches, as needed, to achieve an annual target of 35 $m^2$ and 10 $m^2$ of additional *Cabomba* coverage, respectively. *Cabomba* will not be planting in the reaches where coverage has exceeded the long-term goal based on Fall 2018 SAV mapping. *Cabomba* will be planted using stem cuttings and/ or individual rooted plants. Stemmed cuttings will be collected from the New Channel and / or the spring-fed pool. The cuttings will be bundled into fist-sized bundles wrapped with rubber bands to keep bundles together. The *Cabomba* cutting bundles are typically 12 to 32 inches in length and will be planted at a depth of 2/3 their length, if possible, in soft, silty sediment. This planting depth prevents *Cabomba* from loosening and floating away and ensures multiple nodes are buried for production of good root structure. Rooted *Cabomba* will also be utilized and will be harvested from areas in the Comal River system where *Cabomba* is abundant. The rooted plants will then be planted individually. Both the stemmed cuttings and rooted plants will be planted in a grid-pattern at 1ft centers. Significantly more than the targeted coverage of *Cabomba* will be planted in order to account for plant die-off. Approximately 20 *Cabomba* plantings are needed to achieve 1$m^2$ of coverage. Therefore, approximately 600, 400, and 100 *Cabomba* plants will be planted in the Landa Lake LTBG, New Channel LTBG, and the Upper Spring Run LTBG reaches, respectively to achieve target annual coverage in each reach. Approximately 700 and 200 *Cabomba* plants will be planted in the Upper Landa Lake and Lower Landa Lake restoration reaches, respectively, to achieve target annual coverage in each reach.

*Sagittaria* will be planted, as-needed, in the most suitable locations in the Upper Spring Run LTBG, Upper Landa Lake and Lower Landa Lake reaches only on an as needed basis to achieve an annual target of 5$m^2$, 50$m^2$ and 25$m^2$ of additional *Sagittaria* coverage, respectively, at full grow out.

*Sagittaria* will not be planting in the reaches where coverage has exceeded the long-term goal based on Fall 2018 SAV mapping. *Sagittaria* will be planted as transplants harvested from Landa Lake. The leaves of the transplants will be trimmed prior to planting to decrease buoyancy and drag. Approximately 12 *Sagittaria* plants are needed to achieve $1m^2$ of coverage.

*Potamogeton* will be planted in the most suitable locations in the Landa Lake LTBG reach to achieve an annual target of 5 $m^2$ of additional *Potamogeton* coverage at full grow out. *Potamogeton* will be planted using bare-root rhizomes that are harvested from the Comal River system. Approximately six rhizome sections need to be planted to achieve $1m^2$ of *Potamogeton* coverage. Therefore, approximately 30 *Potamogeton* rhizomes will be planted in the Landa Lake LTBG reach to achieve the target annual coverage.

Competition between native plants has been observed where *Vallisneria* and *Sagittaria* will encroach on and take over *Ludwigia* and *Cabomba* stands. To minimize the effects of competition and to promote the growth and spread of *Ludwigia* and *Cabomba*, buffers will be created around planted *Ludwigia* and *Cabomba* stands to the extent practicable. Any plant material that is removed during this activity will be collected and removed from the lake/ river.

Following planting of native SAV, gardening and maintenance will occur on a monthly basis between March and October to assess health of plants and to identify and remove any non-native vegetation that is beginning to establish within planting areas.

**Monitoring:**
Routine monitoring will occur in order to identify re-establishment of non-native aquatic vegetation. Planted areas will also be monitored to assess expansion, die-off, and competition by native and non-native aquatic plant species. Once native aquatic vegetation is established in an area, monitoring will be conducted on a less frequent basis.

Seasonal vegetation mapping in the Landa Lake, New Channel, and Upper Spring Run LTBG reaches and the Upper/ Lower Landa Lake restoration reaches will be conducted to evaluate SAV coverage and to assess progress of aquatic vegetation restoration efforts. Mapping is conducted by circling the perimeter of vegetation stands with a kayak equipped with a Trimble GPS unit. Mapping will occur in January, April, and October. The October mapping event will be used as a basis for assessing overall SAV coverage with respect to meeting long-term vegetation goals and developing annual restoration goals for 2021 and subsequent years.

**Budget:**
Table 7.1:
$50,000

Available budget:
$50,000

Estimated 2020 budget:
$100,000*

*The increase of $50,000 in the budget for this task will be offset by a decrease in the budget for Task 5.2.2.1: Old Channel Aquatic Vegetation Restoration

### 5.2.3 Management of Public Recreation

Public recreational use of the Comal River ecosystems includes swimming, wading, tubing, boating, canoeing, kayaking, golfing, scuba diving, snorkeling and fishing. To minimize the impacts of incidental take resulting from recreation, the City of New Braunfels will continue to implement existing recreation control measures as specified in Section 5.2.3(1) of the EAHCP and will seek voluntary participation in the Certificate of Inclusion (COI) program from outfitters who facilitate recreation activities within the Comal River system.

**Long-term Objective:**
To minimize and mitigate the impacts of recreation on endangered species habitat within the Spring Runs, Landa Lake and the Comal River.

**Target for 2020:**
Continue to enforce existing restrictions that limit recreational access to Landa Lake, Spring Runs, and the Old Channel of the Comal River.

Inform river recreation Outfitters of the EAHCP COI program.

**Methods:**
The City will continue to enforce City Code Sections 86-4 and 142-5 that restrict recreational access to Landa Lake, Spring Runs, and the Old Channel. Trained Park Rangers will continue to patrol applicable areas to prevent illegal access to these waterbodies.

The City will continue to work in conjunction with EAHCP program staff to develop COI program documents and strategies. The City will reach out to local river outfitters to inform them of the COI program once a framework for the COI program is established. The COI will include the minimum requirements as specified in EAHCP § 5.2.3 (2) a-h.

**Monitoring:**
Monitor the status of participating outfitters to comply with the minimum COI outfitter standards and requirements set forth in Section 5.2.3 of the EAHCP.

**Budget:**
Table 7.1:
$0

Available budget:
$0

Estimated 2020 budget:
$0

### 5.2.4 Decaying Vegetation Removal and Dissolved Oxygen Management

**Long-term Objective:**
Maintain adequate dissolved oxygen (DO) levels within Landa Lake for the protection of the biological community, including the fountain darter. Minimize and mitigate oxygen consumption caused by decaying vegetation.

**Target for 2020:**
Collect DO data spatially throughout Landa Lake and the Upper Spring Run during low-flow periods (<100 cfs discharge at Comal Springs). Displace floating vegetation mats, as needed, that form on Landa Lake to prevent oxygen consumption by decaying vegetation (management of floating/ decaying vegetation will be funded and accomplished through Task 5.2.10: Litter and Floating Vegetation Management). Remove decaying vegetation from Landa Lake and Upper Spring Run during low-flow conditions (<100 cfs), as needed, to mitigate low DO levels caused by low-springflow and decaying vegetation.

**Methods and Monitoring:**

Approximately six logging DO sensors (e.g., comparable to MiniDOT sensors available from Precision Measurement Engineering [PME Inc. Vista, CA] that have been used in prior years) will be installed in key documented fountain darter habitat areas in Landa Lake during periods when Comal Springs discharge decreases below 100 cfs. The sensors will be downloaded and cleaned routinely, as needed, to prevent fouling. The main objective of this 2020 data collection is to establish DO conditions during low-flow events and prompt DO mitigation activities.

Aquatic vegetation conditions and floating vegetation mats will be visually observed on a regular basis (i.e. weekly at minimum) to assess for signs of stress, die-off. Floating aquatic vegetation and dead aquatic vegetation has the potential to cause oxygen depletion from the decomposition of the vegetation itself and from reduced atmospheric reaeration. Should vegetation die-off be observed due to low-flow or if floating vegetation mats reach impactive levels (if mats cover >25% of the mid-lake area or if individual mats are >3 meters diameter), displacement or removal of the decaying vegetation or vegetation mats will take place within one week of identification as part of Task 5.2.10.

If low springflow conditions (<100cfs) occur and vegetation decay or low DO is evident, intensive displacement or removal of decaying vegetation will be implemented, as appropriate, under Task 5.2.10. Intensive refers to the frequency of vegetation mat management being more than once per week. Displacement and/or removal will be conducted in the least disruptive method tested to be effective, to limit any additional DO stress from stirring, turbidity, etc.

**Budget:**
Table 7.1:
$15,000

Available Budget
$15,000

Estimated 2020 budget:
$15,000*

*To be utilized only if low-flow conditions (<100cfs) are realized at Comal Springs.

### 5.2.5/5.2.9 Non-Native Animal Species Control

The City of New Braunfels will continue to implement a program to reduce non-native animal species in the Comal River system. The non-native animal species that will be targeted include the suckermouth armored catfish, tilapia, nutria, and ramshorn snail. Since this work plan has two components identified within the EAHCP, each component has been broken out to facilitate the development of the work plan and budgets.

**Long-term Objective:**
Reduce populations of non-native animal species to minimize their direct and indirect impacts to the Covered Species and the Comal River ecosystem.

**Target for 2020:**
Continue existing program to remove non-native invasive species, including tilapia, nutria, and suckermouth armored catfish from the Comal River system utilizing removal methods proven successful in previous years. Continue to record counts and biomass of removed species per removal effort.

**Methods:**
Invasive species including armored catfish, tilapia, and nutria will be removed from Landa Lake and portions of the Comal River during routine removal sessions. These sessions will occur year-round.

Tilapia and suckermouth armored catfish will be targeted throughout the Comal River system primarily by divers with spearguns. Gill nets will also be utilized for capturing tilapia and armored catfish within Landa Lake. Gill nets will be set primarily at the southern end of Landa Lake.

Upon removal from the water, all invasive fish will be eviscerated, in accordance with state laws and disposed of. The carcasses will be measured (in inches) and weighed (in pounds). Total biomass of the removed fishes will be calculated. Total length of non-native fishes will also be measured to determine if, over time, the removal of adults affects target population demographics.

Box traps baited with carrots, sweet potatoes, and apples will be utilized to capture nutria. Traps will be placed in areas frequented by nutria (evident by slides, scat, chewed vegetation, lake-wall erosion and damage, and other observations). The traps will be checked in the late afternoon and again the next morning at approximately 7:30 am. Captured nutria will be euthanized. Removed nutria will be measured (in inches) and weighed (in pounds) prior to being disposed of**.**

**Monitoring:**
Over the past few years, each fish species has shown a significant decrease in average length and weight as compared to 2013 data. This decrease in size may indicate that removal efforts are suppressing the population's ability to gain adult mass and capacity to breed. The removal program will record following information:

- Date of removal.
- Number of hours worked.
- Type of species removed.
- Removal method.
- Number of individuals caught/speared.
- Total weight of individuals removed.

- Length of individuals removed.

The data provided will be used by EAHCP staff to generate catch per unit effort and determine the effectiveness of the removal program.

The EAA Biological Monitoring program will also assess the status of non-native species populations and any impacts of non-native removal to the Covered Species.

**Reduction of Non-Native Species Introduction and Live Bait Prohibition**

**Long-term Objective:**
Minimize the introduction of non-native species to the Comal River system.

**Target for 2020:**
The City will continue to work towards the development of an ordinance or other mechanism designed to control introductions of non-native aquatic organisms to the Comal River system. The ordinance or alternative mechanism will specifically address the usage of live bait and aquarium dumping.

**Methods:**
City staff will draft an ordinance prohibiting aquarium dumping and the possession of certain live bait species. The City will consult with Texas Parks and Wildlife Department on the regulation of live bait. The ordinance will be presented to City Council for consideration.

**Monitoring:**
The EAA Biological Monitoring program will detect the presence of newly introduced species.

**Budget:**
Table 7.1:
$75,000

Available budget:
$75,000

Estimated 2020 budget:
$50,000

### 5.2.6/6.3.6 Monitoring and Reduction of Gill Parasites

**Long-term Objective:**
To assess the threat of the gill parasite (*C. formosanus*) on fountain darter populations by monitoring the host snail (*M. tuberculatus*) and gill parasite cercariae density and distribution in water column concentrations.

**Target for 2020:**
Perform gill parasite cercariae water column concentration monitoring during low-flow conditions (<100cfs). Analyze monitoring data to determine the overall effect and potential threat of the gill parasite to fountain darter populations.

**Methods:**
To quantify the density of drifting gill parasite cercariae in the Comal River study area during low-flow periods (<100 cfs), the same three transects (LL, OCR, RVP) sampled in 2015-2019 will be sampled in 2020. It has been concluded that during normal flow conditions and with the existing abundance of host snail, there is not a significant threat to fountain darter populations caused by the gill parasite (BIO-WEST, 2017). Past research has indicated that gill parasite cercarial concentrations may increase during drought conditions (BIO-WEST, 2017). Therefore, drifting gill parasite cercariae monitoring will only be initiated if low-flow conditions are realized.

**Figure 4** illustrates the gill parasite cercariae monitoring locations. The three sampling transects are considered locations that adequately represent the Comal Spring system and are efficient for long-term monitoring of drifting cercariae.


**Figure 4**. Gill parasite cercariae monitoring locations

At each of the selected transect locations, 5-L water samples will be collected from six points that are evenly distributed throughout the water column both horizontally and vertically. For each transect, three sampling stations will be established that are equally spaced across the stream channel perpendicular to flow. At each of these stations, two 5-L samples will be collected, one approximately 5 cm from the surface and one at 60% of the depth at that location. Samples will be collected using a modified livewell pump attached to a standard flow/depth measurement rod and buckets marked at the 5-L volume. At the time of collection, each water sample will be immediately treated with 5 milliliters (ml) of formaldehyde to kill parasite cercariae, thus facilitating their capture (live cercariae can wiggle through the filter device). Filtration will involve passing the sample through a specialized filter apparatus containing three progressively finer nylon filters, the final filter having pores of 30 microns. After filtration of each sample, the 30- micron filter containing cercariae will be removed from the filtration apparatus and placed in a Petri dish. Each sample will then be stained with Rose Bengal solution and fixed with 10% formalin, at which point the Petri dish was closed and sealed with Parafilm for storage. Cercariae on each filter will later be counted using high-power microscopy at the BIO-WEST laboratory.

In 2020, cercarial monitoring will be conducted once only if and when Comal springflow decreases to less than 100 cfs.

**Budget:**
Table 7.1:
$75,000

Available budget:
$75,000

Estimated 2020 budget:
$10,000*

*To be utilized only if low-flow conditions (<100cfs) are realized at Comal Springs.

### 5.2.7 Prohibition of Hazardous Materials Transport Across the Comal River and Its Tributaries

The City of New Braunfels will continue to prohibit the transport of hazardous materials on routes crossing the Comal River and its tributaries.

**Long-term Objective:**
To minimize the potential for accidental spills or releases of hazardous materials into the Comal River system that may cause negative impacts to the Covered Species.

**Target for 2020:**
Maintain signage installed in 2016 and monitor for the presence of trucks carrying hazardous cargo on routes crossing the Comal River and its tributaries.

**Methods:**
City of New Braunfels Ordinance No. 93-7 effectively restricts the transport of hazardous cargo within Loop 337 and IH-35 and therefore, over roadways crossing the Comal River. Hazardous cargo route prohibition signage was installed in 2016 at key roadways near the headwaters of Landa Lake and the Comal River.

**Monitoring:**
Hazardous cargo restriction signage will be monitored and replaced/ repaired as needed. The City of New Braunfels Police Department will monitor for trucks carrying hazardous cargo on prohibited routes per City ordinance.

**Budget:**
Table 7.1:
$0

Available budget:
$0

Estimated 2020 budget:
$0

### 5.2.8 Native Riparian Habitat Restoration (Comal Springs Riffle Beetle)

**Long-term Objective:**
Establish a healthy, functioning riparian area along Spring Run 3 and the western shoreline of Landa Lake to benefit the Comal Springs Riffle Beetle. Establish native riparian vegetation to increase the stability of the bank, decrease erosion/ sedimentation and increase the amount of available food sources (i.e. course particulate organic matter) for the riffle beetle.

**Target for 2020:**
Monitor and maintain previously restored riparian areas along Spring Run 3 and the western shoreline of Landa Lake. Plant additional native riparian plant species within the riparian buffer area, as needed, to increase the density of vegetative coverage in this area. Remove any re-emergent non-native vegetation and maintain erosion control berms.

**Methods:**
Monitor the riparian zone along Spring Run 3 and the western shoreline of Landa Lake twice/ year, once in late spring/ early summer (April-June) and once in the fall (October) to assess for the re-emergence of non-native vegetation and to monitor the status of native plants and erosion control berms.

Mechanically remove any observed re-emergent, non-native invasive plant species within the riparian zone along Spring Run 3 and along the western shoreline, as needed.

Plant supplemental native plants, as needed to increase density of riparian buffer area. Native plants will be selected based on root structure, light requirements, drought tolerance, growth habits and deer-resistance. Candidate native plant species may include, but will not be limited, to those in **Table 4**. Re-construct erosion control berms as-needed.

**Table 4.** Candidate riparian plantings

| Sun Species | Shade Species |
|---|---|
| Turks Cap (*Malvaviscus arboreus var. drummondii*) | Turks Cap |
| Frostweed (*Verbesina virginica)* | Frostweed (*Verbesina virginica)* |
| Yellow Bidens (*Bidens laevis)* | Emory Sedge (*Carex emoryi* ) |
| Swamp Milkweed (*Asclepias incarnata*) | Boneset/ Mistflower (*Ageratina havanensis*) |
| Switchgrass (*Panicum virgatum*) | Elderberry (*Sambucus canadensis)* |
| Bushy bluestem (*Andropogon glomeratus*) | Giant spiderwort (*Tradescantia gigantean)* |
| Emory Sedge (*Carex emoryi* ) | Texas aster (*Symphyotrichum drummondii texanum)* |
| Sweetscent (*Pluchea odorata*) | Red salvia (*Salvia coccinea*) |
| Elderberry (*Sambucus canadensis)* | Buttonbush (*Cephalanthus occidentalis* ) |
| Yellow compass plant *(Silphium integrifolium radulum*) | Inland Sea Oats (*Chasmanthium latifolium*) |
| Texas bluebells (*Eustoma exaltatum*) | |

**Budget:**
Table 7.1:
$25,000

Available budget:
$25,000

Estimated 2020 budget:
$10,000

### 5.2.10 Litter and Floating Vegetation Control

**Long-term Objective:**
Minimize the impacts of floating vegetation mats and litter on aquatic vegetation and endangered species habitat in Landa Lake, the Spring Runs, and the upper portion of the Old Channel. Mitigate low dissolved oxygen levels in Landa Lake caused by decaying vegetation. Minimize shading of and negative impacts to aquatic vegetation caused by floating vegetation mats.

**Target for 2020:**
Dislodge floating vegetation mats and remove litter from applicable portions of the Comal River system to prevent negative impacts to flow control structures, aquatic vegetation, and endangered species habitat. In the event of low-flow conditions or receipt of depressed dissolved oxygen levels in Landa Lake, the removal of and/or increased efforts to dislodge floating vegetation mats will be initiated to prevent oxygen consumption by decaying vegetative material.

**Methods:**
*Floating Vegetation Mat Management:* Floating vegetation mats are commonly observed within Landa Lake and are composed primarily of macrophyte fragments, algae, bryophytes and terrestrial debris. The vegetation mats are naturally occurring and are the result of natural processes. Maintenance activities associated with floating vegetation mats in Landa Lake will involve dislodging floating mats and facilitating migration of the mats downstream of Landa Lake. Any litter found within floating vegetation mats will be removed prior to dislodging. Maintenance of floating vegetation mats will occur on a weekly basis between March and September and on an as-needed basis during the remainder of the year. Floating vegetation mats will be dislodged from flow control structures, the Three Islands area, fishing pier and other locations where vegetation mats accumulate and negatively impact native aquatic vegetation. Additional efforts to displace and/ or remove floating and decaying vegetation will occur during low-flow conditions (<100cfs) and/ or when low dissolved oxygen levels are observed in order to further mitigate impacts to dissolved oxygen and native aquatic vegetation.

*Litter Management:* (March 1st to October 30th). Litter pickup within the riparian zone along the Old Channel and the Spring Runs will occur on a bi-monthly basis (twice/ month) between March 1st and October 30th. Litter will also be removed from within the Old Channel and Spring Runs to the extent that it can be removed with a 10ft trash grabber. Removed litter will be quantified and reported on a monthly basis.

**Monitoring:**
Monitor litter and floating vegetation mats in applicable areas on a weekly basis and more frequently if low-flow conditions occur. DO concentrations will be monitored by EAA and as part of Task 5.2.4 (Decaying Vegetation Removal and Dissolved Oxygen Mgmt). City staff will monitor contractor efforts and coordinate additional efforts when deemed necessary.

**Budget:**
Table 7.1:
$0

Available budget:
$0

Estimated 2020 budget:
$30,000* (Funds from Task 5.2.6 [$15,000] and Task 5.2.8 [$15,000] will be reallocated to fund Task 5.2.10.)

### 5.2.11 Golf Course Management and Planning

The City of New Braunfels will implement their existing Integrated Pest Management Plan (IPMP) for Landa Park Golf Course. This process will incorporate public input and the Golf Course Advisory Board. The golf course IPMP will incorporate environmentally sensitive techniques to minimize chemical application, continue to improve water quality, and reduce negative effects to the ecosystem. Expanded water quality sampling targeted at Golf Course operations will be conducted as described in Section of 5.7.2 of the EAHCP.

**Long-term Objective:**
To manage the golf course and grounds in a way that minimizes negative impacts to the aquatic ecosystem in Landa Lake and the Comal River.

**Target for 2020:**
Continue to implement the IPMP and update as needed.

**Methods:**
The golf course and grounds will be maintained in an aesthetically pleasing, yet environmentally sensitive manner. It is the responsibility of the Golf Course Manager to maintain the course and grounds in accordance with the new IPMP. The IPMP describes chemicals and methods for controlling pests (i.e. insects, weeds, and other living organisms requiring control) on the golf course in a way that does not negatively impact water quality or endangered species.

**Monitoring:**
The EAHCP Water Quality Monitoring Program includes base flow and storm sampling at designated locations along the Comal River both up- and downstream of the Landa Park Golf Course. Samples are analyzed for various herbicides and pesticides per the IPMP to control pests and weeds. Detections of any pesticides and herbicides utilized for golf course maintenance operations may warrant the need for revisions to the existing IPMP.

**Budget:**
Table 7.1:
$0

Available budget:
$0

Estimated 2020 budget:
$0

### 5.7.1 Native Riparian Habitat Restoration

**Long-term Objective:**
Increase the area and density of native riparian vegetation, reduce non-native riparian vegetation, and prevent streambank erosion in areas immediately adjacent to the Comal River and Landa Lake to compliment aquatic vegetation restoration efforts and to protect water quality.

**Target for 2020:**
Increase the coverage and density of native vegetation in the riparian zone along the banks of Landa Lake and the New Braunfels Utilities (NBU) Headwaters facility located at the confluence of Blieder's Creek and the Upper Spring Run. (**Figure 6**).


**Figure 6**. Location of 2020 riparian restoration activities along Landa Lake (right) and the NBU Headwaters facility property at the confluence of Blieder's Creek and the Upper Spring Run (left).

Remove non-native riparian vegetation (i.e. Elephant Ears [*Colocasia esculenta]*) from the banks of Landa Lake in the vicinity of Spring Island and on property controlled by the Comal County Water Recreation District #1 (CCWRD#1) across from the "the Island" park (**Figure 7**) and plant native vegetation.


**Figure 7**. Location of 2020 riparian restoration activities in the vicinity of Spring Island and the CCWRD #1 Island Park.

Maintain areas where non-native riparian vegetation were removed in previous years to prevent re-establishment. Monitor and maintain previously planted areas to promote establishment and growth of native vegetation. Maintenance of restored areas in Landa Park will include the installation of permanent fencing, as needed, to prevent disturbance of restored areas by park visitors.

**Methods:**

*Native Plant Restoration:*

Plant native riparian vegetation along the NBU Headwaters facility property located at the confluence of Blieders Creek and the Upper Spring Run of Landa Lake. Native plants will be selected based on sun exposure, proximity to the stream, growth habit, and ability to withstand deer browsing. Candidate native plant species may include those in **Table 5** based on the success of previous restoration efforts. Native plant restoration along the banks of the NBU Headwaters property will include primarily the planting of potted plants.

Establish a riparian buffer zone along Landa Lake near the outflow to the Mill Race/ New Channel (**Figure 6, right**) by creating a riparian protection area. Currently, this area is largely denuded of vegetation with evidence of erosion. The riparian zone will be delineated, soil prepared/ amended, and plants installed to establish riparian vegetation, minimize erosion and stabilize the banks. Soil

preparation will include soil scarification and the addition of compost material. Candidate native plant species may include those in **Table 5** based on the success of previous restoration efforts. Native plant restoration in this area will include both planting of potted plants and distribution of a native seed mix. Permanent fencing will be installed around the perimeter of the riparian protection area to protect the riparian area and prevent disturbance by park visitors. Permanent protective fencing will also be installed around riparian protection areas that were established in 2019 to define these areas as "grow zones" and minimize disturbance by park visitors.

In the area of Spring Island and CCWRD #1 property, erosion control berms will be installed in locations where non-natives are to be treated. Following the treatment of non-native vegetation and erosion control berms, native plants will be installed. Native plants will be selected based on sun exposure, proximity to the stream, growth habit, and ability to withstand deer browsing. Plant restoration in this area will occur in small sections to ensure establishment of planted areas prior to expanding restoration efforts to adjacent areas. Candidate native plant species may include those in **Table 5.**

**Table 5.** Candidate riparian plantings

| **Trees and Shrubs** | **Herbaceous** |
|---|---|
| American Beautyberry (*Callicarpa americana)* | Coral Honeysuckle (*Lonicera sempervirens*) |
| Bald Cypress (*Taxodiumdistichum)* | Creeping Spotflower (*Acmella repens*) |
| Bee Brush (*Eysenhardtia texana)* | Emory Sedge (*Carex emoryi*) |
| Black Walnut (*Juglans nigra)* | Frog Fruit (*Phyla nodiflora*) |
| Burr Oak (*Quercus macrocarpa)* | Frostweed (*Verbesina virginica)* |
| Buttonbush (*Cephalanthus occidentalis)* | Horse Herb (*Calyptocarpus vialis*) |
| Elderberry (*Sambucus canadensis)* | Inland Sea Oats (*Chasmanthium latifolium*) |
| Eve's Necklace (*Styphnolobium affine)* | Switchgrass (*Panicum virgatum*) |
| Fragrant Sumac (Rhus aromatica) | Texas Lantana (*Lantana urticoides*) |
| Green Ash (*Fraxinus pennsylvanica)* | Turks Cap (*Malvaviscus arboreus var. drummondii*) |
| Mexican Buckeye (*Ungnadia speciosa)* | Water Willow (*Decodon verticillatus*) |
| Mexican Plum (*Prunus Mexicana)* | White Boneset (*Eupatorium serotinum*) |
| Mountain Laurel (*Sophora secundiflora*) | Yellow Bidens (*Bidens sp.*) |
| Possum Haw Holly (*Ilex ambigua)* | Woodland Sedge (*Carex blanda*) |
| Red Buckeye (*Aesculus pavia)* | Zexmenia (*Wedelia acapulcensis var. hispida)* |
| Red Mulberry (*Morus rubra)* | |
| Dwarf Palmetto (*Sabal minor*) | |
| Soapberry (*Sapindus drummondii)* | |
| Sycamore (*Platanus occidentalis)* | |
| **Grasses** | **Forbs** |
| Buffalo Grass (*Buchloe dactyloides)* | Texas Bluebonnet (*Lupinus texensis)* |
| Eastern Gamagrass (*Tripsacum dactyloides)* | Purple Prairie Clover (*Dalea purpurea)* |
| Green Sprangletop (*Leptochloa dubia)* | Partridge Pea (*Chamaechrista fasciculata )* |
| Prairie Wildrye (*Elymus canadensis)* | Texas Yellow Star (*Lindheimera texana)* |
| Switchgrass (*Panicum virgatum)* | Gayfeather (*Liatris mucronata)* |
| Little Bluestem (*Schizachyrium scoparium)* | White Prairie Clover (*Dalea candida)* |
| Blue Grama (*Bouteloua gracilis)* | Lemon Mint (*Monarda citridora)* |
| Sideoats Grama (*Bouteloua curtipendula)* | Plains Coreopsis (*Coreopsis tinctoria)* |
| Curly Mesquite (*Hilaria belangeri)* | Indian Blanket (*Gaillardia pulchella)* |
| Indiangrass (*Sorghastrum nutans)* | Tall Goldenrod (*Solidago altissima)* |
| Texas Cupgrass (*Eriochloa sericea)* | |

**Table 5.** Candidate riparian plantings

| Trees and Shrubs | Herbaceous |
|---|---|
| Sand Dropseed (*Sporobolus cryptandrus)* | |
| Sand Lovegrass (*Eragrostis trichodes)* | |
| Big Bluestem (*Andropogon gerardii* ) | |
| Cane Bluestem (*Bothriochloa barbinodis)* | |
| White Tridens (*Triden albescens)* | |
| Western Wheatgrass (*Pascopyrum smithii)* | |
| Bushy Bluestem (*Andropogon glomeratus)* | |

*Invasive Species Management:*

Non-native riparian vegetation (primarily Elephant Ear [*Colocasia esculenta]*) along the banks of Landa Lake, in the vicinity of Spring Island and along property owned by CCWRD#1 will be treated using an aquatic-approved herbicide. Elephant ears will be treated in small sections to minimize overall herbicide usage and to minimize soil/ bank disturbance over large areas.

Monitor areas where non-native plants were removed in previous years. Re-treat and remove re-emergent non-native vegetation.

**Monitoring:**
Previously restored riparian areas will be monitored for the re-emergence of non-native vegetation and success of native plantings. Sediment capture structures will be monitored for effectiveness. Monitor native riparian plantings for success. A riparian assessment will be conducted twice annually in Spring and Fall to evaluate the condition of the riparian zone.

**Budget:**
Table 7.1:
$100,000

Available budget:
$75,000 (available budget less than Table 7.1 due to funds utilized to fund the Bank Stabilization Project in 2016)

Estimated 2020 budget:
$125,000* (Funds from Task 5.2.6 [$50,000] will be reallocated to fund a portion of Task 5.7.1.)

### 5.7.5 Management of Household Hazardous Wastes

**Long-term Objective:**
To minimize the potential for improper disposal of hazardous wastes and associated negative impacts to endangered species in the Comal River system.

**Target for 2020:**
Hold three household hazardous waste (HHW) collection events in New Braunfels. Continue to partner with New Braunfels Utilities (NBU) on the Operation MedSafe drug recovery program.

**Methods:**
Conduct three HHW collection events that incorporate an education and outreach component. The HHW events are coordinated by City's Solid Waste Division in conjunction with Comal County. Each HHW event costs approximately $40,000-$45,000 which includes event set-up and HHW disposal costs. The cost of the first two HHW events is shared evenly between the City and Comal County. The third event is funded largely by the EAHCP ($38,000) with the remaining cost paid for by the City.

The HHW collection events are held at the New Braunfels City Hall. Hazardous waste that is collected during the HHW collection events will be hauled off and disposed of by Clean Harbors.

The City is continuing to explore the feasibility of implementing a HHW drop-off facility that will accept HHW on an ongoing basis throughout the year. Currently, it is expected that a HHW drop-off facility will be opened within three years. The facility will likely be open to the public 1-2 days/ week for the drop-off of HHW.

The New Braunfels Police Department partners with NBU to host an annual medicine drop-off event in New Braunfels. The CONB website also contains information about the Operation MedSafe event and tips on proper disposal of medications and drugs.

The EAHCP adaptive management process may be initiated in future years to consider changes to the EAHCP with respect to management of HHW in New Braunfels.

**Monitoring:**
The volume of hazardous waste material collected and the number of participants for each HHW collection event will be documented.

**Budget:**
Table 7.1:
$30,000

Available budget:
$30,000

Estimated 2020 budget:
$38,000* (increase in budget due to increases in HHW events and disposal costs)

* (Funds from Task 5.2.5 [$8,000] will be reallocated to fund a portion of Task 5.7.5.)

### 5.7.6 Impervious Cover/Water Quality Protection

**Long-term Objective:**
To reduce non-point source pollutant discharges to Landa Lake and the Comal River system.

**Target for 2020:**
The City will implement water quality management strategies identified in the *Water Quality Protection Plan (WQPP): Phase I* that was developed in 2017. Specific activities to be completed in 2020 include the design and installation of a bio-retention basin to be located at the New Braunfels' Utilities (NBU) Headwaters facility that would treat and infiltrate stormwater runoff from remaining impervious surfaces.

**Methods:**
The WQPP that was developed in 2017 includes evaluation criteria for seven water quality retrofit projects within the Comal River watershed as well as recommendations for implementing water quality improvement projects in conjunction with the construction and development of NBU Headwaters facility located along the banks of the confluence of Blieders Creek and the Upper Spring Run of Landa Lake.

The City will work with NBU and the Headwaters facility to construct a bio-retention stormwater treatment basin at NBUs well yard located on the premises of the Headwaters' facility (**Figure 8**). The project will involve removal of existing asphalt pavement. The existing asphalt pavement will be replaced with a bio-retention basin designed to infiltrate and treat stormwater runoff prior to entering the Upper Spring Run of Landa Lake. NBU and the Headwaters facility will assume responsibility of ongoing maintenance of the stormwater facility to ensure maximum sediment and pollutant removal.

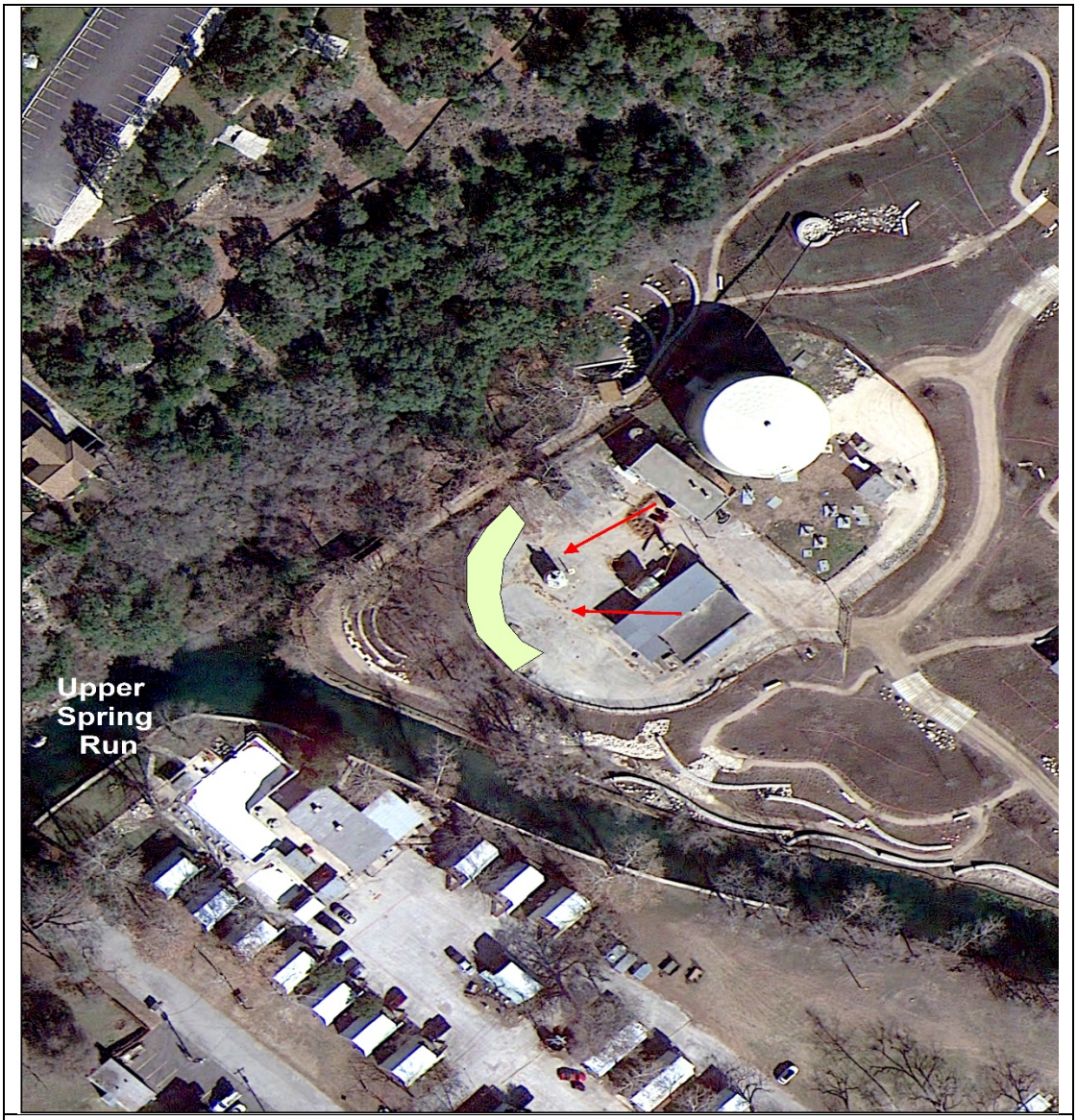


**Figure 8**. Map indicating the location of the proposed bio-retention stormwater treatment basin within NBUs well yard located on the premises of the Headwaters facility.

**Budget:**

Table 7.1:
$100,000

Available budget:
$100,000

Estimated 2020 budget:
$100,000