Progress Report # 1

A TSA/BFREE Collaboration

THE HICATEE CONSERVATION AND RESEARCH CENTER (HCRC)

Submitted to: The Turtle Survival Alliance (TSA)

Submitted by: Jacob A. Marlin
Executive Director
Belize Foundation for Research and Environmental Education (BFREE)

Submitted on: September 22, 2011

Summary:

In response to the need to help secure the future survival of the critically endangered Central American River Turtle, *Dermatemys mawi,* in the wild, TSA has partnered with the Belize Foundation for Research and Environmental Education (BFREE) a non-profit 501c3 organization with 18 years experience conducting conservation initiatives in Belize. *Dermatemys mawi* is locally known in Belize as the Hicatee. The goal of this new collaboration is to develop the Hicatee Conservation Research Center (HCRC) on BFREE property in southern Belize to investigate the reproductive biology of this fresh water turtle in captivity, and to test the feasibility of large scale captive management as a critical component of a broader long term conservation program for the species.

After a number of site visits to Belize and BFREE by TSA Director Rick Hudson and TSA consultants during 2010, plans were developed to begin construction of the facility at the beginning of 2011. With start-up funds of $10,000 provided by the Batchelor Foundation, construction of the HCRC began in February. The site is located on roughly 4 acres of land within the 1,153 acre BFREE private reserve, and when fully operational, will serve as an important part of the BFREE biological research and educational field station. On site project management is currently under the direction and supervision of Jacob Marlin, BFREE's founder and executive director. BFREE staff member Thomas Pop was hired to assist in the construction of the facilities. Mr. Pop is a local Mayan and served as field assistant to Thomas Rainwater during field surveys of Hicatee in April and May of 2010. Pond construction, conducted by a local contractor, Thomas Gomez and Sons Ltd., was overseen by BFREE resident biologist Dan Dourson, who has 20 years experience working as an endangered species biologist for the US Forest Service, with extensive experience constructing ponds as artificial habitat for wildlife.

Since breaking ground in February, 3 large ponds have been installed, 2 breeding ponds (100' x 80' and 120' x 60'), and one bio-filtration/food pond (50' x 40'). A freshwater well has been dug and reinforced, a pump house has been constructed over the well, and a solar system has been installed to power the submersible solar water pump. Fresh water is pumped automatically into the ponds when the sun rises each day and turns off at dusk. Overflow from the breeding ponds flows into the bio-filtration pond where semi-aquatic food plants will be grown. When finished, the HCRC will house close to 50 adult breeding Hicatee and many of the food plants will be raised on site and harvested from the wild. Because of natural predators living in the area (Jaguars, Mountain Lions, Ocelots, Coatis, etc), a ten foot chain-link electrified fence will encircle the ponds to keep out potential predators. TSA and BFREE hope to procure the breeding stock from confiscations from poachers and/or the illegal meat trade directly at local markets in Belize. Completion of the HCRC is planned for December of 2011, and the facility will be fully operational by March of 2012.

Description of Activities During the Period of January – June, 2011

1. Selection of the Site for the HCRC

A considerable amount of effort went into selecting the exact site for the HCRC. Many factors had to be considered including topography, access, underlying bedrock, soil type, access to water and exact placement of a well, distance from existing facilities, forest structure and species composition, and location in relation to future planned development of BFREE infrastructure. A major consideration was the soil matrix, because a high percentage of clay within the soil was preferred to minimize leakage of water within the ponds. Holes were dug at a number of possible locations to test soil quality and underlying bedrock. Once an adequate site was chosen, an area approximately 300'x 300' feet was measured and marked. The site is located about a 5 minute walk east from the center of the BFREE field station facilities and is accessed by an existing trail that passes through the BFREE shade grown organic cacao and coffee plantation. A location for a new road was surveyed and marked for access to the site by heavy machinery such as a bulldozer, dump truck, and front end loader.

2. Site Prep

Pond construction began in early February. A local contractor, Thomas Gomez and Sons Ltd., was chosen to clear the area and prep the site. First, a new feeder road was constructed connecting a nearby existing road to the construction site. Once the road was in place, the forest was cleared at the site. Like all infrastructure projects at BFREE, every attempt was made to minimize any disturbance to the forest and to carefully and selectively remove only the trees that were necessary. Specific trees were selected that would provide some shade to the ponds and be aesthetically pleasing.

A D4 bulldozer was used to clear the area of all trees and debris for the HCRC

3. Pond Construction

Once the area was completely cleared of debris, BFREE staff members measured the exact location and shape of two breeding ponds and two bio-filtration ponds, the exact location of the well and pump house, solar panels, research lab, and other infrastructure. The areas were first marked with flagging and stakes, and then the ponds were dug with a bulldozer. First, the topsoil was removed and piled in a location for future use. Then the holes were dug, and shaped to maximize current existing topography and landscape. Pond construction was overseen by Dan Dourson, the BFREE resident biologist. Dan has been working for BFREE since 2007, and previously worked as a endangered species biologist in the Appalachians for the US Forest Service for almost 20 years. Dan helped with the construction of hundreds of ponds during this period, creating artificial wildlife habitat for amphibians, fish, turtles and other wildlife species. Dan played an important role in helping to construct the ponds by working very closely with the bull dozer operator, ensuring the work was being performed to the specifications as required. Over the course of the construction, and as the ponds took shape, it became clear that it would be necessary to modify the original drawings on paper to suit the actual on-the-ground factors and limitations. In summary, instead of the originally planned two rectangle shaped breeding ponds, 100' x 30' in size, one pond was constructed to be somewhat banana shaped and 100' x 80' while the other was made more oval in shape being 80' x 60'. Both ponds were dug 9' in depth. Material removed from the ground was piled along the perimeter of the ponds to raise the entire area of the site. In addition, another modification from the original design was that one larger bio-filtration/food raising pond (50' x 40') was constructed instead of two smaller ones. This was done to minimize cost, and create a more efficient design.

Cohune palm stalks were used to mark out the perimeter of the breeding ponds.

The D4 starting to dig out the first of the breeding ponds.

During the planning stages of construction it was believed that the soil matrix had sufficient clay to hold water once the ponds were full. However, during pond construction, it became clear that at a depth of nine feet, there was insufficient clay in the soil in certain layers to ensure that water would not leak from the ponds. Due to this factor, Mr. Marlin and Mr. Dourson decided it was necessary to add a layer of clay onto the bottom of the ponds to ensure no leakage would take place. Luckily, not far from the site there is a large deposit of clay of benzonite quality. A dump truck and front end loader was brought in to excavate the clay from this location and transport it to the construction site. Once on site, it was spread over the base of the ponds and

compressed with the bulldozer to pack it in place. The entire process of building the pond was spread out over a two month period, working intermittently during this time due to constraints of weather, availability of the machinery and operator, and site prep planning. In total, the actual amount of time it took to clear the site and construct the ponds was about 7 days of work at 8 hours per day.

Finally, after pond construction was completed, it became necessary to cover the bare exposed soil so that in the on-coming rainy season, erosion would not damage the integrity of the ponds. This was done by using the thatch palm fronds from a common tropical palm called Cohune which is abundant in this area.



BFREE facilities manager Marcelino Pop placing Cohune leaf around the perimeter of the ponds to reduce erosion in case of rain.

1. Construction Materials

The next phase of the project was to acquire the materials necessary for infrastructure and development. This included the equipment and tools necessary for the digging and placement of the well, water pumping, and construction of the pump house. Equipment such as the solar water pump and some hardware was brought in from the USA. Lumber was acquired from a local mill as well as from BFREE land as BFREE has a small sawmill and lumber in stock. Materials for cement were also procured from BFREE property such as sand and gravel, and the cement mix was acquired locally. A 20' plastic corrugated culvert was purchased in Belize City and transported to the site on a trailer for use in the well. Additional materials were acquired locally from hardware stores or were procured from BFREE supplies on site.



Tom Pop and Daniel Tzalam hauling sand and gravel for mixing cement for the floor of the pump house

2. Well Digging and Installation

Location of the HCRC was chosen partially for access to an endless supply of available clean fresh water. During the planning stages, the project director estimated that the site would yield an excellent source of ground water that would not dry up even during the driest conditions. Digging of the well began shortly after pond construction was completed. Two people were hired to dig the well by hand using shovels and a digging bar. After only the second day of digging, signs of water appeared, and over the course of 5 days in total the well was dug. The walls of the well were then reinforced with a 24" diameter corrugated PVC culvert placed in the well vertically, and then packed externally with river rock. The total depth of the well is 16' with a water column of 5' at the bottom during the driest conditions. Once the well water settled installation of the water pump and associated PVC piping and electrical wires were placed accordingly.



BFREE staff members Daniel Tzalam and Saturnino Teul digging the well by hand. A local tree called Moho was used to create a bush-ladder for getting in and out of the well hole. A make-shift pulley system was used to hoist buckets full of dirt, clay and rocks from the hole as digging progressed. Eureka! We struck clean fresh water the second day!



Once the well hole was completed, a 20' long 24" diameter plastic culvert was lowered into the hole and leveled. River rocks were then placed around the perimeter filling up the gaps and securing the culvert in place. Small 1" diameter holes were drilled at regular intervals in the culvert to allow water to pass easily from the water table into the culvert for a quick recharge of the water supply.

4" diameter PVC was then attached to the inside of the culvert as a pump casing. A small gas water pump was brought in to pump out the water from the well at a very high rate to remove dirty water and debris from the well, and also determine the recharge rate of the water table.

6. Pump House

After testing the pump and finalizing the installation of the well casing and pumping equipment, a cement floor was poured at the site and construction of a 10' x 12' pump house/storage room began. The cement was mixed and pored by hand using materials hauled to the site by wheelbarrow from sources on BFREE property. The construction was conducted by BFREE facilities manager and master carpenter, Marcelino Pop, with assistance from Thomas Pop and Daniel Tzalam. The framing of the pump house is made from local hardwoods from BFREE property, milled on-site, and the walls and roof are made of corrugated galvanized aluminum sheet metal. This material was chosen due to its anti-rust and termite resistant properties.

Pile of sand and gravel for cement floor of pump house

Galvanized zinc and lumber for walling and roof

Wood framing for cement floor

BFREE staff members Marcelino Pop, Thomas Pop, and Daniel Tzalam casting the cement floor after the well has been secured.

Hardwoods are used for framing for their termite and rot resistant properties.

7. Solar System and Water Pump Installation

Like all of the BFREE facilities, the HCRC will be powered entirely by a solar system. During this first phase of construction, power needs are restricted to water pumping. Having extensive experience designing, installing, and maintaining solar systems, Mr. Marlin put together a simple yet effective system that requires virtually no maintenance. A system was installed consisting of (4 - 130 watt Kyocera photo-voltaic panels) and a 12 volt submersible water pump and controller box made by Lorentz, a leading manufacturer of off-grid water pumping systems. The panels are temporarily being

mounted on wooden racks, custom designed and made on site at BFREE. The water pump has been placed within a 4” PVC pipe that is mounted vertically on the inside of the well casing, and the pump is lowered in the casing and held in place approximately 12” inches from the bottom of the well. 2” PVC pipe carries the water from the pump up and out of the well and pump house where it is then piped to the ponds. The system is designed so that when the sun comes up each day, the solar panels provide sufficient power to automatically turn on the pump, which begins providing water to the ponds and keeps the ponds constantly full, with overflow gravity fed via PVC pipes into the bio-filtration pond. At sunset, the pump turns off automatically. Installation of the solar system, water pump and all PVC piping and electrical materials were conducted by Mr. Marlin.

The Lorentz 12 volt submersible pump is all stainless steel and brushless, designed for remote applications.

Water is pumped up from the well and out the side of the well casing

2” PVC pipe carries the water up from inside the well casing

The solar panels are located centrally between the two breeding ponds.

The Lorentz PS150 controller regulates the electrical current and turns the pump on and off automatically.

4 135 watt 12 volt solar panels provide sufficient power for the system to operate year round.

8. Filling of Ponds and Testing All Systems

Once the well was in place and all materials on site, the solar panels and water pump was tested and the system adjusted to work adequately for the site. In order to test all systems, a gas powered water pump was purchased in order to fill the ponds quickly with water from the well. This was important to both determine how the water level of the well would react to intensive pumping, as well as filling the ponds to determine whether

there were any leaks present. Over the course of a number of days, water was pumped into the breeding ponds continuously until they were filled. The water level of the well sustained this intensity, and never dropped more than a few inches. The ponds were then allowed to settle, and soak in the water, and were then filled again. This process continued for a few weeks, until the ponds began to stabilize.

ADDITIONAL INFORMATION

9. Challenges in Meeting the Tasks

The primary challenges have been associated with weather conditions. Southern Belize received an unusually high amount of rain later into the dry season than expected which kept the opportunity to begin pond construction from taking place as early as wished. However, once the dry season was underway by March, it continued much later than usual, until mid-June, which had the effect of near drought conditions. This played to our advantage, as the water table was the lowest on record at BFREE (15 years of record keeping) and allowed us to dig the well for the facility as deep as humanly possible without heavy machinery. The dry conditions also allowed us to test the availability of water under the driest conditions, to ensure the well would provide enough water to the ponds at all times. However, once the ponds were dug and lined with clay, and were filled with water, it became apparent after a few weeks of filling and allowing the water to soak into the dry ground, that both breeding ponds had slow leaks. An attempt was made to compact the clay using the resources available (hand made wooden compacters), but before the ponds were finished being compacted the rains began with fury and the lower third of each breeding pond could not be emptied and dried to the point where the clay could be compacted adequately.

10. Next Steps to Achieve Desired Results

The next steps include and are in the following order:

- Finish compacting breeding ponds
- Fill breeding ponds with water
- Install solar system permanently
- Construct fence and electrify
- Construct nesting habitat
- Construct floating islands
- Seed ponds with aquatic vegetation and artificial habitat
- Acquire turtles and implement captive management protocols

11. List of All Staff and Duties on Project to Date

Dan Dourson, BFREE Resident Biologist – Pond design and construction consultant
Gomez and Sons, Contractor – Pond construction and heavy machinery operation
Saturnino Teul, worker – digging of well
Daniel Tzalam, worker – digging of well
Marcelino Pop, BFREE facilities manager/carpenter - pump house construction
Thomas Pop, worker – worked on all aspects of construction
Jacob Marlin, Executive Director. Project oversight - solar system and pump installation

12. Budget (including funds spent to date)

Item	Budgeted	Spent
Site Prep	750.00	750.00
Pond Construction	1,100.00	5,858.75
Fencing	3,000.00	0.00
Electric wire	450.00	0.00
Well and pump	500.00	1,994.86
Water vat	420.00	0.00
Research Lab/Pump house	400.00	564.21
Solar System	3,000.00	3113.32
Tools and Equipment	500.00	507.60
PVC and plumbing	350.00	253.01
Labor	4,000.00	685.23
Transportation	500.00	200.00
TOTALS	**14,970.00**	**13,925.98**

Notes on Budget:

A number of changes to the budget were necessary in terms of actual expenditures that were required in order to undertake the project successfully. Most significantly, additional funds were required to line the ponds with clay, requiring heavy machinery and associated hours of work, which was not projected as a needed expense. In summery, it took more time and resources to construct the ponds than originally thought. The fencing and electrification system has not been purchased yet, as this phase needs to wait until the ponds and stabilized in case there is a need to bring heavy equipment back onto the site. Cost of the constructing the well was more than projected due to the recent increase in cost of the culvert, and the water pump was also higher than projected, but in the long term will save funds in terms of not needing batteries or replacement parts due to its exceptional quality. Funds for the water vat have not been spent to date. Funds budgeted for labor so far has been much less than projected, but will increase as the project continues.

To date, BFREE has spent $3,925.98 over the amount provided by TSA, and the $5,000 additional funds to be provided are now needed to repay costs incurred so far and supply additional funds for the continuation of the project.

DIAGRAM OF HCRC

Hicatee Conservation and Research Center at BFREE