

Lechuguilla Cave Preparation Guide

Introduction

This article is a set of personal observations based on five week-long trips to Lechuguilla Cave, in Carlsbad Caverns National Park, from 2009 through 2013. It is intended to describe what worked and what didn't entirely from my perspective. The content is entirely based on my experience and opinion (with some review comments, noted in the revision history) and does not reflect, or even try to cover, NPS or other requirements that you may need to meet in order to join and to complete a Lechuguilla trip. This document focuses on pragmatic tips to make your week more productive and fun – you cannot neglect critically important conservation and safety requirements set by NPS, and the high standard of care that is set by the expedition organizers. You are entirely responsible for any use that you may make of the content here.

Thanks for the comments from many reviewers which are noted in the revision history at the end of the document. If you have any comments and suggestions on this version, you can send them to:

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The document may be freely distributed to any person who may be interested in it.

Is this Guide for You?

This guide is definitely for you if you have been selected as a participant or alternate for a Lechuguilla expedition which will involve camping for one or more nights in the cave, and you have never done this before. I strongly recommend that you read the entire guide carefully and make sure you get answers to any questions that you may have.

If you are interested in going to Lechuguilla in the future, it is likely that you would get good value from this guide, to help you understand the skills required so you can go out and work on them and develop the credibility to be a candidate for an expedition.

Finally, if you are a veteran of one or more Lech expeditions, you may pick up a few best practices, or conversely you may be able to provide some review comments to make this guide better.

Can You Do It?

If you are planning for this trip, then you have probably been selected as a team member or an alternate for a proposed (or approved) camp trip in Lechuguilla. For a first-timer,

this usually means a week-long camp at Deep Seas, near Western Borehole. This means that **all** of the following must be true:

- 1) You have demonstrated caving experience including long and difficult trips
- 2) You have good vertical caving skills
- 3) You have experience working as a team member in one or more caving projects

If you are not 3 for 3 in this basic list, you can read on to help you plan for future years, but you may as well forget it, you are not going to camp in Lechuguilla this year.

If it's feasible, a great way to field-test your readiness is to do a day trip or two into Lechuguilla. There is usually a good reason that someone may need to do such a trip, such as collecting a sample or changing out a rope, and so they can potentially take you along. It is better to discover any issues on a day trip, as opposed to day one of a planned 8 day trip.

Assuming you meet the very basic requirements, here is some detail on capabilities that you must either have now or must complete acquiring between now and your trip time. The capabilities are in three categories:

- 1) General Fitness
- 2) "Vertical"
- 3) Attitude

General Fitness

Per foot of travel, Lechuguilla is less strenuous than many difficult caves. However, once you add in a higher elevation than many caves (especially if you come from a coast), the substantial elevation changes, and large loads going into and coming out of the cave together with a warm cave temperature, a given day can be very strenuous. Add to this the fact that you will be caving for up to 8 days in a row, and you need to be in good shape.

Your goal is not just to survive the week – your goal should be to be an energetic and capable participant in trips that may be long and difficult. Even as a new team member, your ability to go on a more difficult trip on a given caving day as opposed to a bail-out mop-up trip will move the needle on the total achievement level of the expedition. Your opportunity to shine (and get an invite to return in the future) is the day that the team needs a third to go to a farther-out destination and they are looking at you. Volunteer for the trip and see it through for a productive day, and you have made a real difference.

If you have never gone to Lechuguilla before, you need a fitness program before the expedition, even if you think you are in pretty good shape. Your fitness program can consist largely of lots of hard caving, and that sure would be great, but if this is not available to you (or even if it is), then you should test and extend your aerobic activity

limits in some way that you can measure. Here were my measures. I achieved these and then I found that I was in decent shape for the trip:

- 1) Able to gain 2,000 vertical feet by walking in an hour with no pack (at low altitude)
- 2) Able to gain 3,500 vertical feet by walking in 3 hours with 35 pound pack (from 3,500' to 7,000' asl).

Your measures will be different, depending on where you live and what's available to you. Just don't fool yourself that medium-level activity counts – you should be able to sustain a high level of activity.

I emphasized a high level of activity for up to 3 hours largely because this was most compatible with my schedule, but I found that it was an excellent match to the requirements of a daily Lech trip. On a given day trip, usually you travel to up to 3 hours at a high level of exertion. In Western Borehole, the lead is usually substantially higher in elevation (and up some number of rope drops) than your camp. When you arrive there, you have to not be blown out and still having more than half of your water. Once you arrive at the first lead, you start mapping, which may be difficult but is a lower level of activity. Then on the return you mostly go down drops (again in Western Borehole trips) to get to camp. Basically, if you arrive at the lead feeling good, then you are probably going to be good for the day. This is also a good match to the trip in to Deep Seas camp and out of the cave, because that is also a high level of exertion for about 4 hours.

“Vertical”

Lechuguilla is a jungle gym of rope work. Despite the miles of ropes, the term “vertical” is misleading. A majority of the drops are something other than vertical, ranging from a convenience handline to a rope going up a narrow 70-degree slot. Therefore, you need to know more than just how to go up and down a rope. It is more important that you be able to safely move between different roped travel modes than that you be able to go rapidly up a vertical rope.

Here is a partial list of the rope maneuvers that you need to be able to do:

- 1) Climb a vertical rope
- 2) Climb a high angle rope (seat croll and lead ascender but no foot loop)
- 3) Climb a medium angle rope (lead ascender only)
- 4) Descend a vertical rope
- 5) Descend a high angle or medium angle rope (rappel but with less friction)
- 6) Change over from ascending to descending while hanging on a rope
- 7) Change over from descending to ascending while hanging on a rope
- 8) Cross a rebelay up
- 9) Cross a rebelay up to a low-angle rope
- 10) Cross a rebelay down
- 11) Cross a rebelay down from a low-angle rope

- 12) Cross a knot up on a vertical rope
- 13) Cross a knot down on a vertical rope
- 14) Transfer from ascending to a traverse line
- 15) Transfer from a traverse line to ascending
- 16) Transfer from descending to a traverse line
- 17) Transfer from a traverse line to descending
- 18) Cross a J-hang (from descending on one rope to ascending on another rope or the other rig point of the same rope, hanging in a loop)
- 19) Cross a tyrolean traverse
- 20) Cross a tyrolean traverse with an ascender assist to get to the far anchor
- 21) Change from an angled slope descent to a full vertical descent (Boulder Falls)
 - a. Be prepared to add friction as needed to do a full vertical rappel with the added weight of your camp duffel, likely this means every one of your bars if you are using a rack.

For reference, out of these 21 maneuvers, I have needed to do 17 of them over the past five year (no changeovers, no passing knots on a vertical rope).

From the list above, two items should be called out for special attention:

Item 5, Descend a high angle or medium angle rope: Many rappels in Lechuguilla go down a slope. It is imperative that you be able to set up less than a full rappel. Otherwise you will spend your days feeding rope into your device and cursing. A popular method is a Petzl Simple in a C configuration. I use a full rappel rack with four bars (but there are disadvantages of a full rack, it is bulky and can make certain rebelays more difficult). If you only have experience with a full vertical rappel, you need to practice a lower friction configuration in a controlled environment before you try it here.

Items 9 and 11: Moving to or from a low-angle rope. Sometimes you need to move between a vertical rope and a much lower angle, lower tension rope. A great example is the bottom of the first rope in Apricot Pit (not on route for the Deep Seas camp).

When you are going down, the problem is how to weight your rack on the lower rope without falling on to it. The answer is that after you rig your rack in, you pull yourself laterally away from the rig point by pulling on the upper slack rope until you rack is fully weighted at an angle, then gradually let the high rope out until you are hanging down vertically from the rig point.

When you are going up, the problem is how to un-weight (and then unclip) your cows tail after you have rigged into a lower tension rope that is not going up – you may have no purchase to lift your body straight up. The answer is to clip your cows tail into the lowest available place – don't clip way up on the rig point of the lower rope. In the example case in Apricot Pit, there is a red sling that is there especially for the purpose of clipping your cows tail.

It is hard to explain this topic clearly. If you don't understand (or even if you think you do), then practice under controlled circumstances until you are sure.

Beyond listing this or that maneuver, you need to be able to pragmatically deal with whatever rope configuration comes next in a safe and reasonably efficient manner. You especially need to be able to use your cows tails effectively to move from one rope to another without creating risk.

In order to do this kind of rope work, you must have a versatile rig, which means some variation on a Texas system such as a Frog (on all recent trips where UI have been in the cave, everybody has a Frog). A Mitchell is marginal – some people might like a chest box for Boulder Falls, but don't drag the box all the way to camp. Ropewalkers, like the number 5, are right out! Some cavers supplement their frog with a Pantin on one foot, allowing them to use a Frogwalker on certain drops. If you are good with a Pantin, this can be really helpful.

Whenever you go up and down rope, you need to take special care to leave the rigging, including rope pads, in a good state which is usually the same as when you came to it. One failure mode is that you may climb up over a rope pad, and it seems to be in place as you go past, but then after you are above it, the pad gets moved out of place or the rope is not on the pad. You are responsible for leaving the rigging safe for the next caver, so double-check every rope pad and the location of the rope on the pad after you have passed it.

Attitude

For one week of your life, you need to be able to sustain all of these things:

- 1) Enthusiastic for the next day of caving
- 2) Willing to (or better still, advocating) getting just a few more stations during the current day
- 3) Willing to grab some extra gear, such as a push rope for the day's trip
- 4) Flexible, able to change your plans so that the entire group can be successful. This is symbolized by your willingness to cede your place in the outhouse line in the morning if someone else has a more urgent need, but includes a number of other cases. Don't get the trip you wanted? Oh well. You still get to be in Lech.
- 5) Grateful for the chance to be in world's most beautiful cave, which by miraculous circumstance is not only available for you to explore, but has also been rigged extremely well with thousands of feet of rope that you did not have to buy.

Being an Alternate

A typical Deep Seas proposal includes between 10 and 20 listed participants, of which 6 to 12 people will be initially chosen for the team. The rest are alternates.

If you are new to Lechuguilla, there is a good chance you will be selected as an alternate. In this case, your mission is to be ready for the case when some of the initially selected team members are not able to make the trip.

To be a credible alternate, you need to proceed on the assumption that you are going on the trip. Do the fitness program, practice your rope work, get the gear. Make a contingency plan for time off work.

The odds are actually very good – several recent expeditions have run through their entire alternate list and even looked beyond. The more you prepare (and communicate that you are doing so), the better your odds become. If you do this, the worst possible case is that you will become good and fit, hone your skills, get some great new gear, have a week of vacation time set up, and happen not to go on the trip – not the worst outcome in the world.

One way to mitigate your risk a bit is to put off acquiring some specialty gear that requires no practice (for instance, the new sleeping bag you'll probably need).

Conversely, the expedition leader has the responsibility to communicate with you on your status, especially including the case where you are on deck or close to it. If you haven't heard something in a while, don't be shy – ask what's up. It is perfectly reasonable to ask where you are in the alternate queue, and to expect an answer.

Gearing Up

No matter how well equipped you think you are, you will need to get some gear for the trip. Maybe a lot. As you do this, you will confront the age-old trip decision of whether to make do with what you have or get the excellent new version. While it is always great to make good use of existing resources, the general answer is:

Spend the Money

When you are considering what appears to be an expensive piece of gear, consider the fact that for Lechuguilla there is no entrance fee at all to go to the most insanely beautiful cave in the world, and it is pre-rigged for you – all you need is to get there and be equipped.

Being properly equipped, in this case, means the gear that will do the job very well and is as compact as possible. Is it worth buying the sleeping bag that is exactly right for Lech and weighs only a pound? You bet. It's kind of like buying cams if you are a rock climber. When you are up on lead 15 feet above your last piece and the cam fits just right in the crack, suddenly the \$50 you spent doesn't seem like a lot.

This principle applies not just to the sleeping bag cited in this example, but to all your gear such as stove, cookware, lights, and packs, where better gear can make your life better and save weight.

It also means that if you have some gear that appears to be in decent shape but is partially worn out, consider getting new for this trip. You can save the partially worn out gear for a bop trip near home. Pay special attention to the condition of your boots. When the sole starts falling off one of your boots, it's a hazard, can reduce your productivity, and will make your week a lot less fun.

Total Weight and Bulk

It is normal to have a pack of about 40 pounds when fully loaded with everything (not including your vertical gear, which you will wear). Considering you will have up to 4 pounds of group gear and 6 pounds of water (see note below about dropping 1 liter = 2 pounds along the way), that's 30 pounds for everything except water and before the group gear goes in. It is a good idea to do some practice packing to this target before you travel to the cave. For smaller people, it is probably a good idea to target a few pounds less. Some specialty trips, especially climbing trips, may require about 5 additional pounds of climbing gear.

Bulk is just as important as weight. You will travel with your camp pack on your back for almost all of the trip in to camp and then back out a week later, and while most of the cave is spacious, there are enough annoying spots that anything you can do to reduce bulk without sacrificing on gear you need is a good thing. This is especially true on the trip to Far East camp, described in a separate section near the bottom of the document.

Packing your pack to minimize bulk is an art form. Putting things inside of other stuff, like in the toes of spare aquasox, in your cook kit, squeezing tightly and rolling sleeping pads and bags, and squeezing the air out of packaging is worthwhile to reduce bulk. It is not appropriate to try to pack your duffel for the first time at the Park.

A good target is to get your pack not going up above your shoulder height. If your pack comes up the back of your neck, it is going to hang up at several places where you wish it would not. You may even need to push your pack through several additional places, and this is always more effort than wearing it where wearing is possible. If your pack has an upper pouch that extends it above your shoulders, get familiar with where the upper boundaries are, so that you are not scraping popcorn on ceilings or worse, breaking soda straws when traveling with it.

That said, don't work too hard to get lean on gear. It's just not that hard to get 40 pounds of gear to Deep Seas camp, it's just 4 sweating hours of your life. If something will make you safer or more comfortable for the whole next week, bring it. Besides, if your pack is too light, you'll probably be given extra group gear.

After you have assembled most of your stuff for your camp duffel, it is good to practice with it (thanks to Jen Foote for this suggestion). Load your pack (add some bottles of water to bring it up to 40 pounds), put on your cave clothes, helmet, and vertical gear, and you are ready to practice. Next, remove any breakables from your kitchen table and crawl under it. What's catching or interfering? Is the pack about to fall over your head?

Take your pack off (you are still under the table) and then put it back on your back.
How's it going down there?

This exercise will help you identify gotchas like a poorly fitting pack, inadequate waist belt, or dangling vertical gear. It may also tell you a little bit more about some fitness work you have in front of you. Working with your pack in this way should not necessarily feel easy (it's not), but you should be in control of the situation and able to maneuver, even under the kitchen table.

When you travel to camp, you also need to pay attention to how the extra weight of the camp duffel can throw off your balance when going down hill. From the entrance to the bottom of Glacier Bay, much of the passage is walking, but it is steep downhill walking with a few downclimbs thrown in.

Sleeping

For a week underground, you need to not just survive over night, you need to be comfortable.

- Sleeping bag, the lightest possible. My bag is actually a sleeping bag liner (Note: I run hot, I don't get cold, so you might need more). John Lyles comments that a bicycle touring sleeping bag is about right.
 - Every day before you go out caving, put your sleeping bag back into its carry sack or similar bag, or at least roll it up, so that it does not collect moisture while you are away. You can stuff your camp sleeping clothes in there too.
 - Camp/sleeping clothes. I was happy in the lightest possible silk long underwear I could find. John Lyles comments that his metabolism is colder so he uses medium weight polypro pants and a long sleeve lightweight polypro shirt for sleeping, with clean socks only used for sleeping. The Far East camp (Grand Guadalupe Junction) seems to run cooler than Deep Seas due to a breeze, I was happy to have thicker long underwear there.
- Sleeping pad. I got a full length Thermarest and did not regret the extra bulk for one minute. I would take it again with no hesitation. I loved being on a pad for the whole length of my body when sleeping. Others bring a $\frac{3}{4}$ length Thermarest and use their camp duffel pack for the other $\frac{1}{4}$ of their length, since the camp duffel is lying there anyway.
 - On this year's trip I enviously saw a "Neo" Thermarest pad that is much taller than a standard self-inflating pad, it might be on the list for next trip.
 - Make sure your pad doesn't leak!
- Something that will work for a pillow. The bag for your sleeping bag, filled with some clothes, might work. Candidates include a \$6 "Magellan" (Academy) brand inflatable camp pillow which is decent. On one trip Jeff Bartlett went deluxe with a Thermarest "small" which he was delighted with (but it is big, 7 oz). John

found a fleece pillow sack at REI that is stuffed with his clothes at night, this could be a good option.

- Ground cloth, thin 8' x 4', about 2mil thick. As thin as 1 mil will work if you are careful with it. Don't bring a tarp which is way too bulky – a painter's drop cloth is fine, three dollars at the hardware store and you cut it to size.

Breakfast and Dinner

You need to cook dinner. I recommend cooking breakfast. The cooking kit is:

- One camp stove per 2 people.
- 8 to 10 oz fuel per 2 people (since fuel comes in 4 (110g) and 8 (220g) ounce containers, this probably means 12 ounces). You can't check this on to a plane, someone who is driving needs to bring your fuel. We have found that 8 oz can work for 2 if you are careful – it is likely worth having a reserve 4 oz, either between two people or even as a reserve for a larger set of people.
- One tiny cook pot (up to 16 oz, water only) per two people. Each meal requires about 2 cups of water per person, and a little more.
- Ability to light the stove. Bring a lighter even if you have a peizo starter, just to be sure. The smallest Bic lighters are found at convenience stores.
- Bowl (plastic insulated, optional if you are able to eat from all your original food containers). John eats from pouches, even paper oatmeal pouches.
- Mug (insulated optional)
- Spoon (I brought plastic, which was fine, with 2 spares. A delrin or nylon spoon will not break, you only need one)

The best dinners appear to be the Mountain House dinners, the ones that say "Serves 2". In this case you are both of the people that the dinner will serve – bring one per dinner per person. Smaller people may need less than a full serves-two dinner.

One trick is to repackage each dinner into a 1 gallon ziplock, which reduces bulk and also reduces weight by 3.5 oz per 7 dinners. Lest that seem trivial, consider that you're talking about 3.5 extra ounces of chocolate you can bring. The dinner cooks fine in a ziplock, you can double the bag at cook time if you are concerned. To reduce the bulk, put a pinhole near the top zipper edge in the original foil pouch and squeeze or pump the air out, and tape over the hole with packing tape. It makes the meals solid like a rock for packing.

For breakfast, I did great with 2 packets of Quaker instant oatmeal in various flavors, plus hot chocolate. I think it is really worth cooking breakfast just to have something more hearty than snack bars or cereal with water that has milk powder floating in it.

In both cases, the key is that you won't cook any food in a pot. Just boil the water and pour the water onto the food where it is going to be eaten.

Day Food

Bring whatever you would normally enjoy having on a caving trip, with a couple of adjustments:

- 1) Avoid cans, which weigh too much. Bring food that is more compact (i.e. dry) and you will add a new supply of water from camp every day.
 - a. Brett Cook reports that he brought some small cans of lunch food for a treat, and this worked well for him.
 - b. Some people enjoy pouches of BBQ chicken or salmon, as they have some juice as well.
- 2) Eat somewhat more hearty than quick snacks. In addition to sustaining you through the day, the day food has to contribute enough to your whole sustenance through the week so that you are not starving. For me (I'm 5'10" 190 pounds and eat a lot, you will want to scale to your weight and appetite) this meant:
 - a. Summer sausage (I brought 2 x 11 oz and ate every bit, could have eaten more),
 - b. Cheese (I brought 2 lb the first trip, too much, I ate 1.6 lbs. Second trip I brought 1.5 pounds, gave a bit away and ate the rest),
 - c. Tortillas (brought 10, made sandwiches every morning for the day, ate all of them),
 - d. Beef jerky (12 oz, ate all of it)
 - e. Gorp (I home-mixed from bulk foods, brought about 2 pounds and ate it all)
 - f. And of course chocolate (I brought 16 oz the first trip, way too little, doubled it for the second trip and was happy. A square of dark chocolate is a great gift underground).
 - g. Some other treat that you like. It is not supposed to be all suffering. I brought crystallized ginger, which I love, and had a little bit every day.
- 3) Defend all of your food against mold. If you leave a food container open, mold can easily grow within a few days. Keep ziplocks sealed and, for food that is expected to last the full week, it is better to bring it in several sealed bags. For instance, several smaller (factory sealed) packages of cheese would be better than one big block. Ditto for tortillas, don't pack them all in one ziplock.

Something I did, and it worked really well, was to have snacks handy and continue to eat them through the day. There is always time to grab a quick bite while you wait for the sketcher. It helped me stay energetic and not have to stop for a "meal" break during the survey. Just remember that you must not spill any crumbs when you do this – consider food that does not crumble easily and always eat over a bag to catch crumbs.

A common theme that emerged from post-trip discussion is: Don't bring too much of any one thing – you'll get sick of it. I love cheese, but I'll never bring 2 pounds of cheese to camp again. You can also trade in-camp with others if you find you are running a surplus of something.

Finally, if it comes down to it, don't be too proud to beg if you run really low on food. It's a drag, you won't want to do it, but in the scheme of things, every other person present would rather you be able to continue to contribute to the trip, and there is probably some surplus food around anyway (cheese, anyone?). Drinks will be on you in Carlsbad on Saturday night.

Water

Water is the stuff of life, and no more so than in Lechuguilla. One of the great miracles of the cave is that there are supplies of good drinking water available for your use deep in the cave. For the Deep Seas camp, you will get water from Lake Louise, it is likely the only water source you will use all week.

For the trip in, don't overestimate how much water you will need. For in-cave travel from the entrance to Deep Seas camp, you should need no more than 2 liters. On my first trip I brought 4 liters, drank less than 2, and as a result lugged 4 pounds of extra weight all the way from civilization to camp. Last time I brought only a liter and half and only drank one liter on the way to camp.

So, bring 1.5 to 2 liters of water to camp, but also bring two containers of 12 to 16 ounces each to stage on the way, one at the entrance and one at the bottom of Boulder Falls (some people prefer to leave a drink at EF Junction or at the top of whatever pit you are climbing out of into the Rift level, whether Great White Way or Apricot Pit). You'll enjoy these in a week (you can add a small can of canned fruit at each stop if you want, a great luxury). Bring extra water to drink while walking to the entrance (and walking back a week later) and also leave some in the vehicle for the ride out.

Once in camp, you will want some multi-liter water containers. The camp veterans prefer the mylar wine box liners that you can get in Europe (now replaced by cheap plastic in the USA apparently), but others used Platypus or Dromedary flexible bags, which worked fine. You want at least 8-10 liters for camp use so that you don't have to go for water every night. Platypus water tank is excellent for Lech, 6 L size holds 2 days worth for two cavers cooking. It is very compact to travel with, light, and has handles and a large zipper opening for filling.

For day use, you need up to 3 liters of water capacity. Many trips will only need 2 liters, but some longer trips require 3. People used Platypus flexible water bags a lot, which despite my concerns held up well, none of them broke on anyone during our week. Obviously the collapsible nature of the water bags is good for reducing bulk. Some people use 2-liter soda bottles, which compress well when not full and hold up well. Regardless of what bottles you use, it is a good idea to attach the caps to the bottles in some manner such as with a cord.

From Deep Seas camp, there is a specific process for getting water at Lake Louise, which a camp veteran will show you. Be sure to follow the process exactly – if you screw it up

and contaminate the lake, then no more water source means no more camp, which would be a disaster for future trips.

I brought small envelopes of drink mix to put in the water each day, and enjoyed this – worth the small weight and bulk. You can bring it in bulk in a ziplock too, just be careful not to spill when mixing your drink as the carbs will cause mold in camp.

Another staging trick is to leave a small bottle of water + drink mix at the end of your walk along Western Borehole, wherever you turn off to your lead. Pick it up at the end of your day's caving and enjoy it on the way back to camp.

One last water trick for Deep Seas – since Lake Louise is on the way to most day destinations, you don't have to bring your day water bottles to camp. On the way back from each day trip, just stop off and fill up your water bottles, then leave them beside the trail to pick up the next day.

Waste Disposal

Related to water is, at the downstream end, pee bottles. For each day trip, you need up to 1.5 liter capacity (you'll sweat a lot of water out, you can definitely drink more than you will pee). It is also convenient to have a liter of capacity in camp. One principle which served me well was to have pee bottles that have a notably larger diameter top than all my water bottles. These are easier to pee into (for guys, anyway) and hugely reduce the risk of accidentally peeing into a water bottles (which has happened!). I used 1 quart Gatorade bottles for pee and was pleased.

For pee storage in the latrine area near camp, I previously used gallon ziplocks but it's not a good answer. It is much better to use an expandable water supply bag. If you have 10-12 liters capacity, there's a good chance that would be enough or close to enough and you could always supplement with a few gallon ziplocks toward the end of the week.

Poo: There are two cases: in camp and out during the day. Luckily I have never had to deal with the issue out during the day, or on travel to or from camp. I always bring an emergency bag set, but have never had to field test it. This is probably the case where a robust storage solution is most important.

In camp (actually at the latrine near camp) I simply slit open a gallon ziplock, rolled up the results and placed into another gallon ziplock. With care, several inner ziplocks can go into one outer bag. Then stack them in a personal pile in the latrine area. Last year, I adopted the practice of using a white kitchen trash bag for backup drop zone coverage, and strongly advise doing this. If I ever missed my target bag, there would be no mistaking it on the white kitchen bag. [It apparently has occurred more than once that someone had spillage and then did not clean it up, then someone tracked it all around on the booties, a real problem]

I bring a personal 1 oz container of hand sanitizer and always use it after the latrine, as well as before eating. The 1 oz sizes were silly expensive at REI, I took a larger bottle we had at home and filled a free 1 oz hotel shampoo bottle from the larger bottle.

The use of gallon ziplocks was also part of a gear reduction effort that goes like this: Before going into the cave, transfer Mountain House dinners from their original packaging to gallon ziplocks and discard the original packaging. Cook and eat in the ziplocks (they don't melt or leak, it's fine, although I always used a backup ziplock). Then demote the used ziplocks to latrine duty. Circle of life, you know.

Others used some additional tools whether foil or de-smelling powder. I don't know how much that helps or not, but if you use foil you can stack your poops into a log cabin that can get pretty tall by the end of the week.

The big poop issue is when it's time to leave. On last year's trip, after double-bagging and so on, I put all the poop into a 5 gallon heavy duty ziplock which I had originally brought in for the purpose of being able to carry dirty gear through clean cave areas (did not use it for that purpose). These bags are thick, they seal well. I then wrapped that bundle in turn in my camp tarp. I had no issues with my duffel smelling bad when opened. On the surface, I threw the entire camp tarp into the trash (there is a single specific dumpster where this is allowed, the expedition leader will show you where).

Andy Armstrong showed me a good packing layer trick. Fill the bottom of your pack with stuff you will not need on the way or any time soon (sleeping bag, stove, etc.). Then make a layer with the poop wrapping the camp tarp. Put your day caving pack on top of that for another layer. On top of the day pack, put only the things you will need during the trip out (and it's only about 4 hours from Deep Seas or up to about 8 hours from Far East) plus the surface walk. So, you only open your pack to quickly pick up things that are handy right at the top, and you never delve past the poop layer. If you have an external pocket on your pack, even better (BTW I hang a small water bottle off my seat harness to reduce trips into the pack). Then on the surface, the poop layer is easy to grab as a single bundle and get rid of.

Caving Gear and Clothes

Here is the list of cave gear I brought, and it was all necessary for every day:

- 1) Helmet
- 2) 2 Main Lights plus backup light
 - a. Lithium batteries
 - b. Alkaline ok for backup and/or camp light (Tikka, etc).
- 3) Boots
 - a. Must be non-marking soles
 - b. Make sure that your boots can last the full week. Think 8 regular cave trips. If you are not sure, replace them. Wear them on the surface for a

few full length days with a pack, to be sure they don't cause blisters on your heels. Bring mole skin pads and duct tape for emergencies.

- 4) Socks
 - a. Two spare pairs, I had clean socks on Tuesday and Friday
- 5) Knee pads
 - a. I used athletic, which worked fine. If you repeat trips in Lech, coat them with Aqua Seal and they last for years.
- 6) Elbow pads
 - a. I used athletic, which worked fine
- 7) Underpants
 - a. Two spare pairs
- 8) Shorts
 - a. Make sure the shorts are long enough to comfortably cover everywhere your seat harness will be.
 - b. Spare shorts, use as clean clothing
- 9) Tights
 - a. Optional, most people don't do this. I wore lycra exercise pants on the Far East trip and was really pleased with how they reduced friction on my knees and also between vertical gear and my legs. For most people, grit gets between their knee pads and their knees (both back and front), resulting in blisters and sometimes even requiring a missed day caving.
 - i. A variation on this is to use liner socks with the toes cut out, pulled up your legs to go under your knee pads.
- 10) Short sleeve shirt
 - a. Spare shirt, use as clean shirt (below) and can rotate into wearing the shirt later in the week). Counting the camp shirt, that's three shirts.
 - b. Use each shirt for several days until you are totally done with it. Don't imagine that you can stop using a shirt for a day or two and use it again. By then it will be slimy and horrible, you won't want to touch it.
- 11) Gloves
 - a. One or two spare pairs for later in the week, you will wear through at least one pair. John brings one spare pair, I brought two spares and was pleased I had the extra. I liked the rubber-lined gardening gloves better than the leather work gloves (which accumulated moisture and mud, and got yucky).
 - i. Always throw a spare pair of gloves in your day trip pack (even if it is a worn out pair). That way if you drop a glove down a bottomless crack, you won't be in a world of hurt - traveling without gloves is painful!
- 12) Vertical
 - a. Harness
 - b. Seat/chest croll
 - c. Lead ascender
 - d. Descender

- i. A Petzl Simple is popular and gets good reviews for versatility and safety – in recent trips it has become the strong majority of descenders.
 - ii. I use a full rack despite the large weight and bulk. This probably provides the best safety and capability, and it may be worth the effort. I'm thinking of moving to the Simple.
 - iii. A Figure 8 is discouraged since it is extremely difficult to manage the correct amount of friction, especially going down Boulder Falls with a camp duffel.
 - iv. I previously used a mini-rack, but on the second trip, I became concerned about whether it is a good choice. Andy Armstrong pointed out that for 2+hyper rappels, if you lose the loop of rope over the hyper bar, you are going to be really out of luck since there is almost no friction remaining. The problem is that there are so many rope drops where you can't use 4 bars without feeding every inch of the rope, and a mini-rack only supports either 2 or 4 bars. A mini-rack should only be used if you have mini-rack experience and you are very confident that you can operate it safely.
- e. Long cows tail
- i. I was taught (20 years ago) to use non-locking biners for cows tails, now I use lockers, which don't weight much more. Every so often I will lock a cows tail for confidence and safety.
- f. Short cows tail
- i. Same question about locking vs non-locking
- g. Pantin – This extra foot “ascender” can be useful on long free or almost-free drops, but there is an art to using it. On a prior trip I had decided that they are useless, but gave the Pantin one more try in 2013 and finally got the hang of it. Once you know how to use a Pantin, it can really help with big climbs such as Boulder Falls or the rope series up to Southern Climes. Get some coaching and practice on how to use the Pantin as part of a Frogwalker or as a helper in the standard Frog.
- h. I bring an extra ascender (a Petzl Basic). I have never used it and am still debating whether it is worth the weight to mitigate risk. The ultimate bummer would be a full ascender failure and you'd be totally out of luck for the rest of the week as well as having to borrow gear to get out of the cave. A third ascender can also be used to throw over a difficult lip.
- i. One way to reduce risk is to bring new ascenders which are presumably much less likely to fail.
 - ii. Some people bring light weight emergency ascenders such as a Kong Duck or Microcender, which may be the best compromise.
 - iii. A set of one or two prusiks may be a good light alternative as well.

All clothes, including socks and underpants, should be synthetic. No cotton!

A few notes on lights and batteries: The most popular light in our camps, and for good reason, was a Sten Light. These unfortunately cost about \$300 although it was pointed out that if you cave a lot, the rechargeable batteries pay for the light over time. A fully charged Sten with one fully charged spare battery can easily last the week.

I have been using an Apex from Princeton Tech, and it works fine but it eats batteries (I used 16 Lithium AAs for my first week including the 4 that started in the light). During the back half of the week, I had to ration by going down to the low setting more than I wanted to. The second trip, I brought 24 AAs and used 20. It is likely that there is a more efficient light for battery use than the Apex.

A good principle is: without going crazy on battery weight, bring plenty of lumens. It's good to be able to check high leads, see everything that's around you, and, it's just plain fun to light up a big room (of which there are many and they are generally spectacular). Every two days, check your battery consumption against your expected needs for the full 8 days and adjust your usage (high vs low settings) if needed.

Clean Gear

For some passages such as flowstone, you need clean gear. This means:

- 1) Aquasocks with some kind of gripping sole
- 2) Extra pair of shorts
- 3) Extra short sleeve shirt

It is possible that in some cases clean knee pads and/or clean gloves would be very helpful. It's hard to say whether they are worth the weight. An option relating to gloves is to bring a backup pair that you will use later in the week, and meanwhile for the first half of the week you have a clean pair of gloves (you need to bring them on each day trip for this purpose). It is a good idea to bring backup gloves each day anyway, in case you lose a glove.

Your clean gear should be ziplocked inside your pack – no point in letting it get dirty if you may need it in order to be clean.

Each morning, there is always a discussion of whether to bring aquasocks for the day. The answer is: Bring them! You never know what you will find. You can always bring aquasocks only, so that you at least have the alternative to go in aquasocks and undies.

Staying Clean

In years of caving in Kentucky, I have never worried too much about staying clean during a trip. As long as I could see out my eye sockets, it was all good until it was time to stumble out to the surface after 24 hours.

Lechuguilla is different for several reasons. First and foremost, you have 8 days and 7 nights to manage. Over that whole week there is good value in trying to stay somewhat clean or get clean when needed.

You also have a responsibility to the cave and to the others in camp, to reduce transmission of contaminants to any other cavers and especially to any water source.

Another reason is pictures. Hopefully some time during the week you are going to get a once in a lifetime picture of you in Lech, and you will look better if you don't resemble a coal miner.

Your three tools are:

- 1) Baby wipes – I brought 30 and used almost all of them, obviously from the pictures I could have used all of them.
- 2) Hand sanitizer – bring a 1 oz bottle for general use including after every time you go to the bathroom. Instead of paying extra for a 1 oz bottle, dispense about 1 oz into a little hotel shampoo bottle and bring that.
- 3) A keeping-clean mindset. See below.

Although I was not too successful at this during my first week-long camp (much better on later camps), I noticed that the experienced crew had good systems for keeping them and their stuff clean. For instance, the inside of the day-caving pack was clean and only admitted clean objects (one day I put my elbow pads inside the pack, which got gorilla shit all over everything else, not great). Everything on the drop sheet at camp was well organized and not touching anything else that was dirty. And, cleaning your hands well upon arriving at camp then means that all your camp stuff stays cleaner.

Each evening when you arrive back at camp, make sure not to step over or on to your drop cloth with your dirty cave clothes especially your pants and boots. Undress out of your caving clothes, leaving them off the drop cloth, brush yourself off, then step on to the your drop cloth. Some people like to leave their day caving shirt on for a while at camp to let it dry out, if you do this then brush it off as well as you can before stepping on to your drop cloth.

Related to this is maintenance of your knee pads and elbow pads. If you have been crawling through lots of gypsum during your survey, it is good to shake all of your pads clean before you start the long trip back to camp (you will sweat and gum it all up, then it's hard to remove). Back at camp, it is also a good idea to clean off your pads as well as possible for the next day.

Cave Packs

You will need a camp duffel to bring all your stuff to camp, and also a day-trip pack.

For the camp duffel, the GGG Cheve packs are popular and seem like a good choice. I used an internal frame backpacking pack and this worked fine with one note – I was warned not to depend on the provided haul strap (such straps have broken resulting in packs falling all the way down Boulder Falls and splatting into a yardsale of gear). So, I added several pieces of webbing rigged to other points of attachment on the pack, and all coming together into one top rig point. (See also later comments about the best camp duffel for longer trips such as Far East)

Other duffel choices are Meander, Zoor Alpinist by Jandd Mountaineering, and Petzl. The pack needs to have a good waist strap and cinch straps, but otherwise should have a minimum of straps and hangers that might catch on cave obstacles.

For your camp duffel, you must have the ability to suspend it directly from the base of your seat harness, at a distance just about right for kicking the top of the pack but no higher. You can't wear your camp duffel down or up vertical drops, you would invert and then be extremely unhappy.

You also need a camp day pack. Many people use Swaygo packs which seemed fine. I have been requested to bring something larger than a Swaygo (in order to bring climbing gear on day trips) and so brought a medium-large sized GGG, perhaps a little too big but worked fine all week. Lost Creek packs are also a good option.

General Tools

Here are a few odds and ends.

First Aid Kit – You need the very basic capability to fix cuts, meaning some amount of bandage, tape, and antibiotic. I had no first aid kit other than duct tape and TP, and was lucky to get some help from others in managing a toenail that I had torn off (not in the cave, on the surface prior) during the week. Add a small bottle with pain reliever, tummy med (Pepcid works for me) and Immodium. If you are on any maintenance med, make sure to take your regular dosages along for the week.

Tethers – Lechuguilla is heavily featured with piles of breakdown and bottomless cracks. Instruments come with tethers that you wear around your neck, but survey books and Distos do not. I recommend bringing some 2mm cord and making (and using) tethers for this and any other precious gear (reading glasses, etc.) that you are handling and do not want to lose forever.

Pliers – Probably not everyone needs pliers, but some number of people do. I was really grateful for the use of Andy's pliers when I could not unscrew my triangle to get out of my harness at the top of Southern Climes. On the second trip I brought a small multi-tool which had both pliers and a knife.

Knife – You will need it for various reasons through the week.

Duct Tape – All purpose repair material. Wrap a few feet around each of several water bottles.

The Luxuries

These items are not strictly necessary for the trip, but you may decide that one or more of them would be fun, if you have room in your duffel.

Photos - Hopefully some time during your trip you will get an immortally great photo for your wall. For instance, you and the Three Amigos would be good. The problem is that your regular camera is not going to do a good job. I brought a point and shoot digital and got very disappointing pictures - it was not worth bringing it into the cave. [John Lyles comments that in some cases you can get decent photos from point and click digital cameras provided you have a secondary flash, either corded or slaved.]

I recommend that instead of every person bringing a useless camera, a few people should bring good cameras and make a specific point of getting several nice pictures of each trip participant in a great setting (great settings are easy to come by in this cave). Perhaps you can strike a bargain with someone, you'll bring extra chocolate and they bring their good camera. Whatever it takes. Or, maybe you are the one with the good camera (such as a digital SLR) and can strike a bargain the other way.

Music – It is feasible to bring an iPod with speakers on the trip for music around camp and along big passage. I think it's fun. Not everyone needs to bring music, I would say that one or two does the job.

Camp Ambience – Several people brought candles set up with a foil reflector to use at camp. I'm not sure you could use the candle light to do much anything useful, but it splits the difference between running your headlamp and being in total darkness during meals and other times at camp.

Sitting Pad – The cave is sharp. You find this out during breaks in day trips. During day trips on my first week I often wished for even a small scrap of blue foam to sit on. During the second week, I brought a scrap of foam carpet underlayment, which was very light and I was pleased. If you bring a sitting pad, keep in mind the problem relating to keeping the inside of your pack clean – you don't want to sit on a pad and then stick it back into your pack. So, if you bring a sitting pad, I recommend a bagging system for when you put it back in your pack.

We have found that a sitting pad also make a great push pad – when you are pushing a small lead, lay the pad over the sharpest part of the floor and you can slide right through instead of cutting yourself up.

Camp Seat – Several people brought camp seats (the kind that fold up your sleeping pad). It's pretty costly in weight (maybe 8 ounces) but I was envious. It's hard to say if this is worth it.

Mapping

A core goal of your trip is almost certainly to map new passage. A few notes about that:

Instruments – Many shots in Lechuguilla are high angle. Practice lots of high angle shots (even 50+ degrees) to get ready. The issue with compass is obvious (the light is way above or below the floating dial). Practice tricks like sagging a line between two high angle stations so you can shoot to the sag instead of the actual station. With clino there is a subtle issue being that since you are often shooting down an inclined rift, it can be hard to set up vertically as opposed to parallel to the angle of the passage you are in. Be extra careful to set up the clino vertically regardless of the crazy angles around you.

This assumes you are not using a Disto-X, which solves all of these problems.

Sketch – You need to be an approved sketcher for specifically for Lechuguilla, so it is unlikely that you will sketch on your first Deep Seas trip. If you are approved, you have received extensive information about what's required.

Point – There is an art to setting point in Lechuguilla. Probably most important is to recognize the important role of the hanging station. In much of the cave, you can hang some flagging down from the ceiling (or "upper" wall) into a prime spot in the middle of the passage that will be good to shoot and will look forward well to the next station. In this case you need to mark (use a bullseye) exactly where the actual station is along the flagging. Along the same lines, don't hesitate to use verticals, even short ones. For instance, you can even set up two stations, a few feet apart, on the same hanging piece of flagging. Ideally, watch an expert set point for at least one day before you set point. [Stan Allison comments that the tape used for hanging stations gets brittle and may break after a few years, so it is still very important to have non-hanging stations that are resting on the cave surface.]

Inventory – Every survey must have a set of inventory pages where the various materials present at each station are noted. If you have never been in Lechuguilla, you won't be able to identify all the materials from inspection. However, a productive way that you can do inventory is by getting help from the group identifying what is where. This is a great way to learn all about the stuff that is in Lech. So as long as you can figure out the arcane way that the inventory pages are set up (reviewing this is a good surface and then camp activity), you can do this role.

The Surface

Before and after the trip, you need to navigate the surface. Carlsbad Caverns National Park is a 45 minute drive from the rest of civilization, so once you go up the hill you won't want to run back down for forgotten items. If you are coming from El Paso, it is out of the way to go to the town of Carlsbad so you actually want to get everything you need at El Paso. The Visitor Center has a cafeteria, and you might score a meal there but you should not count on it.

Before you arrive at CCNP you want to have with you supplies for dinner (that night) and 2 breakfasts (the next morning and a week later), as well as snacks to eat after you get out of the cave. Don't worry about dinner after the cave trip, people always go to Carlsbad for a feast.

You will be staying at an NPS hut near the Carlsbad Cave entrance. It will have bunks but no mattresses. If you want, you can choose to use the same light self-inflating mattress that you will use in the cave, but the smart people bring something more comfortable like a real inflatable mattress. Depending on the time of year, it can also be a good idea to bring a heavier sleeping bag than you will use inside the cave (or you can have the opposite problem in the summer. and be wishing for a light sheet instead of your hot 55F bag).

The hut is maintained only by people who use it – that's you. If you see something that needs cleaning, it's calling you. Ants and mice thrive, so you can't leave out any food and you need to keep all surfaces clean of spilled food.

When driving from the hut to the cave on game day, look ahead to what you'll want a week later: A large trash/leaf bag or two where you can put your yucky cave gear and duffel, another trash bag to sit on so you don't get the car seat filthy, a few of liters of water, a few snacks that won't go bad during a week inside a car (salty chips are great, you'll crave them), and a change of surface clothes.

Far East Camp

This guide as a whole has been geared largely to the Deep Seas camp near Western Borehole. This section has a few notes that are specific to the Far East.

The trip to the Far East is much longer and harder than the trip to Deep Seas. You should only go to the Far East if you have done the Deep Seas trip and thought that the trip to camp was not difficult, or if you have equivalent experience.

Firstly, this means that you should be even more fit than is required to go to Deep Seas. No matter what, the trip in to the Far East camp will be long and difficult.

The rope work on the trip to the Far East is far more technical. The most visible expression of this is the Aragonitemare, where you have to do as many as 5 rebelayes including one that is entirely free hanging, while your camp duffel hangs below you.

You must be able to keep everything straight as you transfer from one rope to another, with no tangles and keeping your duffel positioned so that it does not get wound around the rope you are leaving.

As well as being longer, the non-vertical travel includes quite a few smaller passages. For this reason it is even more critical that you compress your gear as tightly as possible. It is not the weight that kills, it's the bulk. Experiment to see just how small you can pack your sleeping bag, using either compression straps or duct tape.

I regretted using a surface backpacking pack as my duffel, and envied the other cavers' caving-specific PVC duffels which appeared to glide past sharpens and grabons with relative ease. For my next Far East trip, I will definitely have a duffel like that (the surface backpack was fine for Deep Seas).

After you suffer all the way out to Far East camp, suddenly the trip becomes much the same as Deep Seas. Sleep each night, cave each day, tell jokes that you can't when you are on the surface. Most days have vertical because you go down Gorilla Pit and Ruby Chamber drop, but after a few days they become routine. Don't worry about the trip out even when the trip in kicked your butt, after a week you will be leaner and stronger, and your pack will be smaller. And, you will be motivated. You will find yourself appreciating some very fine scenery that you don't recall ever seeing before, because it was just a blur on the way in. "What is this Nirvana place, have I been here before?"

Southwest Camp

The trip to the southwest camp is slightly harder than the Far West trip, but it is a lot easier than the Far East trip. Some notes from the Far East section above may apply, just less so.

Safety and Conservation

If you are an experienced caver, you may think you know all about safety and conservation, but there are topics specific to Lechuguilla Cave that it's worth refreshing on before every trip into the cave. For that reason, NPS requires that everyone on a trip must attend a briefing before each trip. This is a really worthwhile meeting so bring your coffee or tea and pay attention – there is always some new topic or update to discuss, such as updated policies, or changes to the rigging on trade routes.

One recurring theme from the briefing is: Clip in! If you are wearing your vertical gear and there is a rope in front of you, it is almost always a good idea to clip to the rope in some way. Don't embarrass your heirs by falling down a pit while wearing full vertical gear, not having clipped to the rope that was there.

Good luck!

Be safe, don't hesitate to ask questions, and have a great trip.

Revision History

Version Date	Purpose	Review Comments
November 18, 2009	Initial	Stan Allison, Andy Armstrong, Bonny Armstrong, Jeff Bartlett, Brett Cook, Jen Foote, Joyce Hoffmaster, Pat Kambesis, John Lyles, Tanja Pietrass
August 5, 2010 (For Peer review)	Revision based on Far East expedition 2010	John Lyles (Extensive comments), Jeff Bartlett, Pat Kambesis
June 27, 2011	Additions on waste management, other minor edits	Simeon Warner
December 21, 2013	Minor revisions based on 2013 Far West trip: Notes on Pantin, safety and conservation briefing, update on descenders, minor edits.	