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REPORT ON TRAINING PROGRAM
FOR TOPOGRAPHIC SURVEY,
NUEVA CANAAN, BOLIVIA
NOVEMBER 1978

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INTERTECT

I. Training Program

The intent of the training program was to enable a team of residents of Nueva Canaan to conduct a topographic survey of their community and to make a map of it with one-meter contours.

The group selected for the program included five men from Nueva Canaan, plus Mario Romero, the COMBASE agricultural technician living in Nueva Canaan. Mario had some previous limited academic exposure to surveying and enthusiastically assumed responsibility for carrying out the training program to the project's completion.

All of the men made arrangements to participate in the training program full-time (which meant a commitment from 8:00 A.M. to 6:00 P.M. daily except Sunday, from Thursday, November 16th through Thursday, November 23rd). Their level of enthusiasm, motivation and interest was very high; their level of aptitude was mixed and ranged from very quick-to-learn to never really getting the drift of it.

In order to facilitate the speed of teaching the material, I had hoped to work with each individual, teaching him his special task. However, this proved to be impossible as everyone wanted to learn everything (which, of course, has its advantages). The problem was that it was difficult to proceed any faster than the slowest learner.

The approach that was selected for the training program was to give the team members as complete an overview as possible, so they could see the relationship of the various facets, and then to get them directly involved with the process and instruments as quickly as possible. Then we would return to a classroom situation to demonstrate the theory and practice the skills on a "need to know" basis. The team worked intensely with the instruments as early as possible. I feel the procedure worked very well with a few exceptions.

The classroom work dealt basically with demonstration of the techniques for using the transit and rod; how to measure correctly with a tape; map making; and, most difficult, how to properly take and calculate field notes. This invariably occupied all of the mornings. The afternoon schedule was filled with field practice demonstrating these principles.

I had hoped to develop visual aids in the form of posters or other materials. Unfortunately, time did not allow for this. I did, however, write a few pages

outlining procedures for accomplishing some of the tasks, the form for field notes and basic formulas.

The crucial issue, of course, is how effective the training program was. Perhaps only time will tell. My observations were that at least one person learned each detail well. However, in actual field practice, the person who actually knew a particular detail may have been fulfilling a different role on a particular day. Or simple arithmetic or procedural errors would be made, even though the task had ostensibly been learned. In other words, only rarely did the entire team really "have it all together" at any one time. I do feel that, at the speed they were learning and improving techniques, and with more practice, they will be quite capable of proceeding with and completing the work. The one exception is referred to elsewhere in this report regarding the drawing of contour lines on the map.

The above reflects my opinion. On the other hand, most of the team did express to me that they felt insecure in completing the job without further supervision, and hoped that I would return next April or May to supervise the work along the river. I would like to do that, but also suggested that it might be adequate for me to review their field notes (in the form of photocopies) and their map with plotted points, which they could mail to INTERTECT.

Mario also suggested that his instructor in topography at the university might be willing to come to Nueva Canaan for such supervision. This solution obviously makes a great deal of economic sense. The drawback may be, though, that he would disagree with what and how I taught the team, and might introduce a new methodology. This could very well be counter-productive.

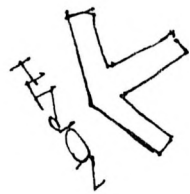
My own objective was to teach only to a level of sophistication using the simplest methodology that would be sufficient to meet their needs. Consequently, the methodology of the training program was based on personal judgment of the basic information necessary to accomplish the task, and is certainly not up to the standards of professionals in this field.

II. Method Established to Execute the Topographic Survey

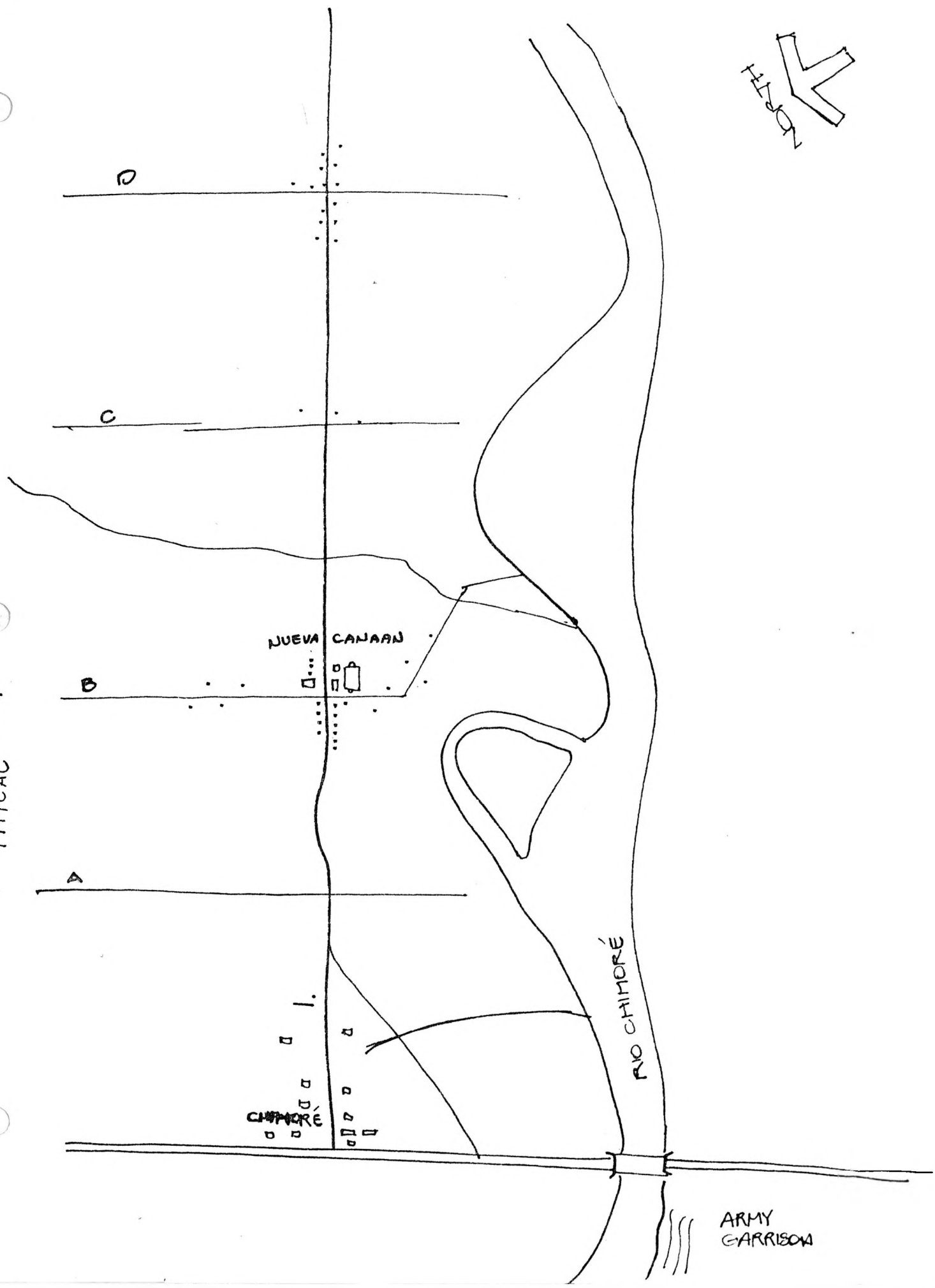
A benchmark was established on an existing concrete post of unknown depth but standing about 20 cm. above ground. It is located roughly 80 meters east and 40 meters south of the intersection of roads 1 and B in downtown Nueva Canaan. An altitude of 300 meters above sea level was used, roughly where we assumed Nueva Canaan to be. On my last day there, a better-located concrete post was found adjacent to the same intersection, so I suggested that it become the primary mark but that the original elevation be maintained.

The direction of north was established with an alignment of the original benchmark and another concrete post located near the far goal of the football field. All future levels and bearings will relate to these references.

From this beginning, a reference point was established in the middle of road B. The team headed east, toward Rio Chimoré. The initial layout of Nueva Canaan was achieved by locating these concrete posts at lot lines, generally at right angles to the road. One would be roughly 30 meters into the field from the road, and a second one about 60 meters in. They were at 182 meter intervals, a data that corresponded with the memories of the original settlers. We had the good fortune of finding all of these over a distance of about 800 m.



2.25 km
* TYPICAL *



CHIMORÉ

NUEVA CANAAN

RIO CHIMORÉ

ARMY GARRISON

The transit would be located over a 6-inch spike in the road, on a line with a bearing of $90^{\circ} 0'$ E. From there, the concrete posts were sited to the south of the road. Random points were sited to the north. Altitudes, bearings and distances were always recorded. The precedent was established to always complete a half-day's or whole day's work with a level circuit to check the accuracy of the altitudes. I told the team that an error of 2 cm. was permissible over a distance of 500 m. The experience of the first few days showed that this was attainable. (The first level circuit taken had no error; the second had an error of 36 cm., part of which was in the field notes and the rest in an error of reading the vertical angle viewer by $0^{\circ} 05'$. In other words, a correction to 0 was attained. Very good work.)

On my final day, the team started to work down the road 1, south toward the village of Chimoré.

III. Anticipated Program of Completion of Surveying

The team worked full-time from the day after my arrival until my departure, i.e. an entire week. Consequently, they were behind with field work and the rainy season was starting in full force.

It was anticipated by Mario, and the team seemed to concur, that they would continue working on the survey as time, field work and rains permit. In other words, they hope to reach Chimoré by December. However, they do not anticipate finishing the work along the river until the rainy season is over. This river-bank area is from 5 km. to 8 km. from their homes -- a long way away to be caught in the rain with no protection or transportation. They expect this work to be completed by May 1979.

IV Mapping

I supplied the team with a large quantity of metric graph paper, pencils, pencil sharpener, metric engineer's scale, triangles, and circular protractor, to enable them to draw the map of the community.

After each day of field practice with the equipment and field notes, we would draw up the map in terms of plotting points sited and their altitudes. The use of the scale, selecting the appropriate one for the task, etc., seemed to be clearly understood. In fact, this simplified version of map-making may have been the easiest thing for them to learn.

Unfortunately, all of the initial field exercises were too flat to have any one-meter differences to illustrate the concept of contour lines. When this deficiency became apparent, time had run out. I gave them a brief lesson on how to draw contour lines, but they did not have any actual practice. It was clear that the concept was not completely comprehended.

The team will need further training in this area to enable them to draw their own finished map with contour lines. Another option would be for them to mail to me copies of their field notes and rough map with point elevations on them and I could complete the map.

V. Observations on the Flooding Problem

Mario took me to see the Rio Chimoré at the end of road B in Nueva Canaan and from the bridge. The following are my observations:

1. It seemed that the problem of erosion could be more expeditiously solved by straightening the river in the immediate area than by a levee system.
2. Inasmuch as the army base at the bridge is threatened, the bridge itself is in danger of more serious damage, the technical school near the bridge is threatened, in addition to the settlement of Nueva Canaan and neighboring communities, all of the above agencies or groups should share in the solution. CORDECA did suggest that they could offer heavy machinery to help.
3. Although the erosion has been serious, I suspect it has gone into Nueva Canaan about as far as it may go. In any case, it has really only affected about three families in the Nueva Canaan area.
4. It should be determined whether one of the causes of the erosion has been deforestation and other agricultural practices. Perhaps the solution would be to leave a buffer of virgin jungle along the riverbanks.
5. The opposite side of the river is scheduled for development. I do not think it should be considered "abandoned".
6. Any solution that is considered should take into account the actual population being served or protected. There are only about sixty families living in Nueva Canaan. The cost-effectiveness ratio should be a factor in determining a solution. (There are probably about one hundred families from the village of Chimoré at the highway to road D, including Nueva Canaan, a distance of about 9 km.)

VI. Impact of the Training Program on the Community

Judging the full impact of this training program on the community is, of course, only relevant in terms of its usefulness in reducing the problems created by the flooding. In the meantime, however, other effects and benefits can be anticipated.

Based on my conversations with community representatives and the surveying team, there is already a sense that they are beginning the process of dealing with the problems. In fact, a meeting was held on my last day there to express their gratitude and hopes for just that.

The team members themselves and others in the community also saw additional benefits of having a surveying team at hand. Some farms were never accurately plotted and now they can be. Fields can be measured and subdivided. A system of levees or other measures, built on the scale of an individual farm, can also be plotted.

On the other hand, some negative aspects were also emerging. The team members were beginning to see that their newly acquired skills could well become a supplementary source of income for projects other than community flood protection. Some non-team members expressed the opinion that, by virtue of having the privilege of learning the skills, the team members owed it to their neighbors to provide their services free of charge.

Similarly, the issue arose concerning who controls the instruments. The co-op wants control. I left the instruments in the hands of COMBASE when I returned to the U.S., so that they could make suitable arrangements with the community. It is obvious that whoever controls the instruments will have something to say about how they are used and who pays for what.

The team members also wanted a certificate to indicate that they had completed a course in surveying. I was unable to provide them with one at the time. It might be advisable for COMBASE to draft one to give to each team member.

VII. Recommendations

The team has had adequate experience to learn the surveying techniques they need to know. However, they lack self-confidence and continue to make technical errors that may invalidate their work. This condition extends to the COMBASE agriculture technician, Mario Romero.

The team should have more support and review of their work. Mario is willing to enlist the aid of his former professor of topography from Cochabamba, which may be an adequate solution. Or I could review their field notes and preliminary map for evaluation. A third possibility would be for me to return for one week next April or May to supervise and retrain for their work along the river bank.

Considering the importance of this work, the latter alternative may be the best. Unfortunately, it is also the most expensive, and perhaps some other option can be found.

There was not adequate time to teach the drawing of contour lines. I recommend that either I draw them from field note data, or that I write a short course on the subject, mail it to them, and request that Mario instruct them.

I would also recommend that any further INTERTECT involvement in this program include a cost-benefit analysis of various flood protection approaches. My feeling is that a levee system that would fully protect the community would cost a great deal. The results of this approach include reducing erosion from two or three farms and reducing some crop damage. I am not sure that these results justify the expenses to be incurred. Such an investigation should also consider the ecological consequences of farming in this particular zone of the jungle.

PT:jwp

ITINERARY OF ACTIVITIES

Saturday, November 11

Morning: Practiced working with the new transit.

Afternoon: Began flight from Madison.

Sunday, November 12

Morning: Continued flight.

Afternoon: Arrived in Cochabamba, 4:30 p.m.

Monday, November 13

Morning: Met Wilfrin Hinojosa; bought the tools and supplies that I could anticipate needing.

Afternoon: Hinojosa took me to CORDECA office where I talked with engineers about the mud slides and visited several sites.

Tuesday, November 14

Morning: CORDECA engineers took me to top of Pinto Mayu site, and we walked down to foot of mountain.

Afternoon: Waited in vain for COMBASE to give me a ride to Nueva Canaan. Bought more supplies.

Wednesday, November 15

Morning: Left Cochabamba at 7:00 a.m.; arrived at Nueva Canaan by 12:00.

Afternoon: Was given a motorbike tour of Nueva Canaan and of the two points where one can see the river.

Evening: Met with community leaders to plan for the program in topography.

Thursday, November 16

Morning: Introduction and overview of the entire concept of surveying as related to Nueva Canaan, procedures, processes and objectives. Course on reading a tape.

Afternoon: Introduction to use of rod and transit. Introduction to process of keeping field notes.

Friday, November 17

Morning: Course on taking field notes for a level circuit.

Afternoon: In field, we ran a level circuit of schoolground, football field area and surveyed the lot of the COMBASE clinic.

Saturday, November 18

Morning: Made a map of Friday's level circuit. Practiced field notes, practiced reading the transit.

Afternoon: Surveyed a 200 meter stretch of the nearby Rio la Jota.

Sunday, November 19

Morning: Attended La festival de La Piña.

Afternoon: Prepared lessons for coming days.

Monday, November 20

Morning: Made map of Rio la Jota area. Reviewed field notes. Introduced vertical angles.

Afternoon: Began surveying road or "senda" B.

Tuesday, November 21

Morning: Made map of senda B. Reviewed field notes, horizontal angle, bearing and vertical angle using stadia reduction tables.

Afternoon: Continued surveying senda B.

Wednesday, November 22

Morning: Made map of Tuesday afternoon's survey. Practiced vertical angles.

Afternoon: Discussed how to complete surveying the entire area. Practiced with the transit--rained all day.

Thursday, November 23

Morning: "Examination" and review of all materials. Answered questions, tried to put to rest lingering doubts.

Afternoon: Began surveying senda 1. I prepared written materials for reference and review.

Friday, November 24

Morning: Took 8:00 a.m. bus to Cochabamba; narrowly avoided missing plane to La Paz due to switched schedules caused by coup. Arrived home Saturday afternoon.

INVENTORY

Inventory of equipment purchased and left with COMBASE and the Cooperativa de Ahorro y Credito of Nueva Canaan.

	<u>Pesos</u>	<u>\$U.S.A.</u>	<u>Receipt</u>
1. Transit and its:			
case			
lens cap			
lens shade			
plumb bob			
2. Tripod		434.91	X
3. Book <u>Topografia</u>	216		X
4. Book <u>Topografia para Ingenieros</u>			
5. 2 plumb bobs		8.30	X
6. 50 meter tape measure	1,333.45		X
7. 1 kg of 6" nails	20		X
8. Surveyor's colored field tape		1.40	X
9. Calculator and batteries		3.20	X
10. 4 packages of graph paper		1.96	X
11. Metric engineer's scale	125		X
12. Round protractor		3.75	X
13. 3 pencils and sharpener		.65	X
14. Scotch tape		1.05	X
15. Paint to make surveyor's rod	50		X
16. Paint brush	8		
17. 2 field notebooks		2.90	X
18. 2 copies of stadia reduction tables		.40	
19. 2 triangles (architect's)		1.95	X
20. 2 pieces of wood and a hinge to make rod	50		

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	<u>Pesos</u>	<u>\$U.S.A.</u>	<u>Receipt</u>
21. Tracing paper; photocopy field notes	100		
22. Newsprint paper	<u>20</u>	<u> </u>	X
Divide by 20	1,923	\$461.47	
SUBTOTAL	\$ 96.00	461.47	
		<u>96.00</u>	
TOTAL		\$557.47	