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MEMORANDUM

To: Ken MacLeod
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Date: 24 March 2005

cc: John Darch
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Rupi Khanuja
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From: Subir Sanyal

Subject: Testing Sequence for Meager Creek Wells

The visit of John Darch and Rupi Khanuja to our office last Monday yielded a fruitful discussion of the Meager Creek project, with participation by Eduardo Granados, Jim Lovekin, and myself. Andrew Ryder also participated by phone toward the end of the meeting. This memo is to summarize the consensus that emerged from the meeting with respect to the recommended sequence for testing the Meager Creek wells.

The main point of general agreement was that it would be advantageous to test MC-6 after the completion of MC-8. The principal reasons for this is are discussed below. MC-6 will not initiate flow without being air lifted for several days. While it may be possible to mobilize a coiled tubing unit to do this air lifting, the close proximity of the MC-6 and MC-8 wellheads and the limited space on the pad make this a risky proposition, especially in a scenario in which both MC-6 and MC-8 are flowing at the same time. A second reason is cost. Rental on a coiled tubing unit of sufficient size to lift MC-6 is likely to cost on the order of $15,000/day, plus mob/de-mob fees on the order of several tens of thousands of dollars. The drilling rig on site can run drill pipe to lift MC-6 — but only after it completes its work on MC-8. A third reason is limited injection capacity. If MC-6 kicks off on air lift and MC-8 begins flowing spontaneously during drilling, the site at present has only the capacity of the sump and injection into MC-7 as options for water disposal, and both these options afford minimal capacity. Therefore, for reasons of logistics, safety, cost, and injection limitations, an attempt to test MC-6 while drilling MC-8 is not advisable.

A second point of general agreement was that it would be premature at this point to plan on drilling an MC-9 well from the same pad as MC-6, -7, and -8. The only scenario in which drilling MC-9 from this location makes sense would be if one or two of the existing wells (e.g., MC-6 and/or MC-8) prove to be strong producers — then MC-9 could be drilled to a downhole target adjacent to the successful well(s), with enough spacing to avoid undue interference. Absent demonstrated strong performance in at least one well, prospects for success of MC-9 from the same pad would look bleak. A high-angle (virtually horizontal) well to the north has been considered, but this would be a very high-risk and expensive proposition for drilling in

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high-temperature granites, almost unprecedented in geothermal practice. Also, both MC-6 and -7 have showed very deep water tables, largely a function of the high elevation of the pad. Our wellbore simulation work on MC-6 has indicated that this makes it very difficult to initiate flow, because of heat loss in the upper part of the wellbore. An MC-9 on the same pad would likely be subject to the same constraint.

A third topic of discussion concerned ways of stimulating MC-6, -7, and/or -8 in the event that none of them proves capable of self-flow after air lifting. The two alternatives here are acidization and long-term injection. Acidization would require the ability to flow the well back immediately to recover the dissolution products. Airlifting to accomplish this flow-back could be performed by the drilling rig on site, or alternatively by a coiled tubing unit after the drilling rig has departed. Either way, the cost of acidizing at this location is likely to be in the range of $250,000 - $400,000 per well (toward the higher end if only one well is acidized). Long-term injection represents a low-cost alternative, but positive results would only be apparent after several months. The idea here would be to inject at low rates (possibly just a siphon from the water source) into the most promising well for several months, after the rig and most of the camp equipment have been demobilized. GeothermEx has seen some instances in which long-term injection of cold water into hot reservoirs stimulates permeability (possibly by gradual clean out or enhancement of fractures due to thermal shock). However, success of this technique requires not only an extended period of injection, but also time for the well to recover in temperature before another flow test is attempted. This alternative may apply in a scenario where development operations (e.g., the drilling of MC-9) are continuing in another part of the field.

Given these discussion points, the following is an attempt to outline likely well testing scenarios from this point forward.

(1) A likely scenario is that MC-8 will be similar to MC-6 when it was first drilled, i.e., it will have encouraging temperatures and some indications of permeability, but it will be incapable of self-flow until it has heated up. The testing sequence here would entail doing unto MC-8 as was done to MC-6 (i.e., an air lift followed by an injection test, then leaving the well to recover in temperature over a period of several weeks). This testing would probably not require injecting into either MC-6 or MC-7, so both these wells would be available for further evaluation. After the injection test on MC-8, the drilling rig would be moved back over the MC-6 wellhead to perform an air lift (using the already mobilized air compressors). This air lifting might be extended to several days (up to a week), to provide the maximum opportunity for heating the upper portion of the wellbore. The hoped-for result here would be that MC-6 demonstrates self-sustaining flow. If this is the case, both MC-7 and -8 would be available for injection. If MC-6 is so productive at this point as to exceed the injection capacity of MC-7 and -8, then this unfortunate constraint will have to be conveyed to the world, but it will be basically good news. If MC-6 sustains flow at a rate that can be accommodated by MC-7 and/or MC-8, then a long-term test will be possible, and this will also be good news. If MC-6 does not sustain flow, then

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the possibility of acidization can be considered (before or after the rig departs). If acidization does not work (assuming the project is still going forward), then long-term injection into MC-6 can be initiated, and similar testing of MC-8 can be undertaken when that well has had time to heat up (e.g., late summer 2005). Acidization of MC-8 using a coiled tubing unit may be considered at that time, if needed. When these possibilities have been exhausted, one will be able to feel confident that this drilling and testing campaign at Meager Creek has been given its best chance of success.

(2) A more optimistic scenario is that MC-8 encounters such wonderful permeability and temperature during drilling that it spontaneously starts flowing. At this point, the best course of action will probably be to dispose of water into the pad sump and MC-7 as long as possible, and then to shut the well in for further evaluation. The rig would then be moved over MC-6 to conduct testing as described in scenario (1), with the exception that MC-8 would not be used for injection. If MC-6 were to prove incapable of self-flow, it could then be used as an injector to allow more extensive testing of MC-8. At the conclusion of testing MC-8, the rig would be used to drill MC-9, targeting a downhole location near MC-6 or -8, as appropriate.

(3) A more pessimistic scenario is that MC-8 is more like MC-7. In this case, the testing sequence looks much the same as scenario (1), but the hopes of the project ride much more heavily on a favorable result for MC-6.

Other permutations are of course possible, but this is probably sufficient to give you the flavor of what can be anticipated (on both up-side and down-side) for the project from this point forward.

Best regards,

Subir