WOODWASTE TO WINE: A UNIQUE LANDFILL CLOSURE

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ABSTRACT

Louisiana Pacific (LP) operated the York Ranch woodwaste landfill near Ukiah, CA to accept sort yard and sawmill debris from its local mill. By 1993 the waste stream was being diverted to other uses, and LP decided to close the 42-acre (17-hectare) landfill. Prescriptive California Chapter 15 closure regulations required a 1-foot (30-cm) thick compacted clay cover overlain by one foot of topsoil. In lieu of this prescriptive closure, a unique closure was proposed, and eventually constructed, that would convert the landfill into a vineyard. The final cover consisted of 3 to 4 feet (0.9 to 1.2 m) of site soils, without a clay barrier layer, that would support a vineyard. A down-gradient ground water interception pond and a water balance were used as justifications for the alternative design. The benefits of the final project are that an expensive (and technically questionable) clay liner was avoided, and the end use of the property met the needs of the land owner.

BACKGROUND

Site Geology and Geometry

The York Ranch landfill is located in a canyon that drains to the nearby York Creek. The canyon sidewalls slope at 2H:1V to the canyon bottom, which is filled with between zero to 30 feet of alluvium and colluvium. The sidewalls and floor beneath the alluvium are comprised of a relatively low permeability (estimated _ cm/sec) material called the Ukiah formation. The alluvium is substantially more permeable than the Ukiah formation (average estimated to be _ cm/sec). The longitudinal slope of the canyon bottom is approximately 7 percent **[JC to verify]**, which is also the approximate ground water gradient in the alluvium.

Landfilling occurred on the canyon alluvium and against the canyon sidewalls between 19__ and 1993. Ground water compliance monitoring has been performed at the canyon mouth downgradient of the landfill where the alluvial ground water tends to focus before entering as underflow to York Creek.

Closure Considerations

When LP decided to close the site in 1993 the California regulations required a 1-foot (30-cm) clay layer overlain by a minimum 1-foot (30-cm) thick topsoil layer. This type of closure would be incompatible with the desire of the property owner, from whom LP

was leasing the land, who wanted to convert the land into a vineyard. Not only would the clay layer inhibit the growth of the grape vines, but the vine roots would tend to compromise the integrity of the clay as a barrier layer.

There were two other significant disadvantages to using a clay cover. First, construction of a clay cover over 42 acres (17 hectares) would be very expensive. The clay materials would require borrow source testing, possible importation of soil that would need to be purchased, a high degree of control on moisture conditioning and compaction, and extensive quality assurance monitoring. Second, LP and its consultant recognized that the long-term integrity and performance of a clay cover is questionable. Even though many states have historically accepted clay covers as adequate environmental closures, there are substantial academic questions and technical evidence that clay covers on landfills can be expected to perform poorly in the long run[1].

PROPOSED DESIGN

To meet the property owner's goal of turning the closed landfill into a vineyard, LP and its consultant proposed an engineered alternative to the California Chapter 15 regulatory requirements. The engineered alternative consisted of the following key elements:

- Final cover would be site soils at least 3 feet (0.9 m) thick. An additional 1 foot (30 cm) of amended topsoil would be placed in the vineyard growing areas.

- The existing toe of the landfill would be excavated back approximately 400 feet (120 m). The removed waste would be used to regrade other areas of the landfill to improve storm water control and maximum vineyard growing area.

- The toe area would be further excavated into the alluvium and converted into a holding pond that would intercept ground water. A bentonite slurry wall would be keyed into the Ukiah formation across the canyon at the downstream end of the holding pond to prevent further downstream migration of alluvial groundwater.

- Storm water runon and runoff from the site and surrounding terrain would be directed away from the holding pond, and into sedimentation basins further downgradient of the landfill.

The key element of the engineered alternative, which was used to justify omission of the clay cover, is the ground water holding pond. The pond was designed to have zero surface water discharge. The capacity was selected with a safety factor to collect all direct precipitation, and ground water that would flow in the alluvium from beneath the landfill for 8 months of the year (fall through spring). The water in the pond would then be used for irrigation of the vineyard during the growing season. (Note that the water in the holding pond is only a portion of the total irrigation needs of the vineyard). Irrigation water is applied at agronomic rates so there would be no liquid recharge back through the landfill due to irrigation.

In addition to providing a zero-discharge water balance, the alternative cover design would be expected to provide a high level of moisture storage capacity during the winter given the greater final cover thickness, and enhanced evapotranspiration rates from late spring until fall due to the vineyard. Figure 1 presents a conceptual profile of the landfill, holding pond, and cutoff wall.

A closure plan incorporating the alternative design was prepared in accordance with the California Chapter 15 guidelines and submitted to the Regional Water Quality Control Board[2]. The design was favorably reviewed and regarded as innovative, simple, and effective.

FIELD INVESTIGATION AND COMPUTATIONS

Outside of standard grading and surface water drainage, the key project element that required detailed design was the size and geometry of the ground water interception and holding pond.

Three borings were executed along the projected alignment of the slurry cutoff wall. The purpose of the borings were to classify the alluvial soils, determine the depth to the low permeability Ukiah formation, and perform slug tests in the alluvium to estimate its permeability.

An overall permeability of _ cm/sec was estimated for the alluvium. Using the estimated cross-sectional area of the alluvial unit of _ square feet (_ square meters), an annual inflow of _ gallons (_ liters) of groundwater was used as the design basis.

Direct precipitation into the catchment area of the holding pond for a _-year storm was added to the estimated ground water flow to require a minimum holding pond size of _ gallons (_ liters).

CONSTRUCTION AND VINEYARD PLANTING

Approval from the state allowed construction to proceed during the summer of 1995. An added benefit of the simple design is that there were less potential construction problems, and LP was able to perform most of the construction with their own equipment and operators (except for the slurry wall). Construction went smoothly and was completed in September(?) of 1995.

Soil conditioning (addition of organic and fertilizer soil amendments) will be performed in the vineyard growing areas over the next 2 to 3 years. Vineyard planting is expected to implemented in 3 to 4 years after the topsoils have been fully conditioned.

CONCLUSIONS

The geometry and hydrogeology of the York Ranch site allowed a water-balance approach as an alternative to the prescriptive clay cover for final landfill closure. The benefits of using the zero-discharge water balance are that the owner's goal of converting the site

into a vineyard is possible, the closure costs were substantially reduced, and the design is deemed more protective of the environment in the long run than the minimum prescriptive standard. A water balance approach may be a practical and environmentally sound alternative to consider for many other forest products, as well as municipal, landfills.

REFERENCES

(1) Koerner, R.M., and Daniel, D.E. "Better Cover-Ups" Civil Engineering Magazine. May 1992.

(2) EMCON. "Final Closure and Post-Closure Plan for York Ranch #3 ...**[JC should complete this reference]**, 1995

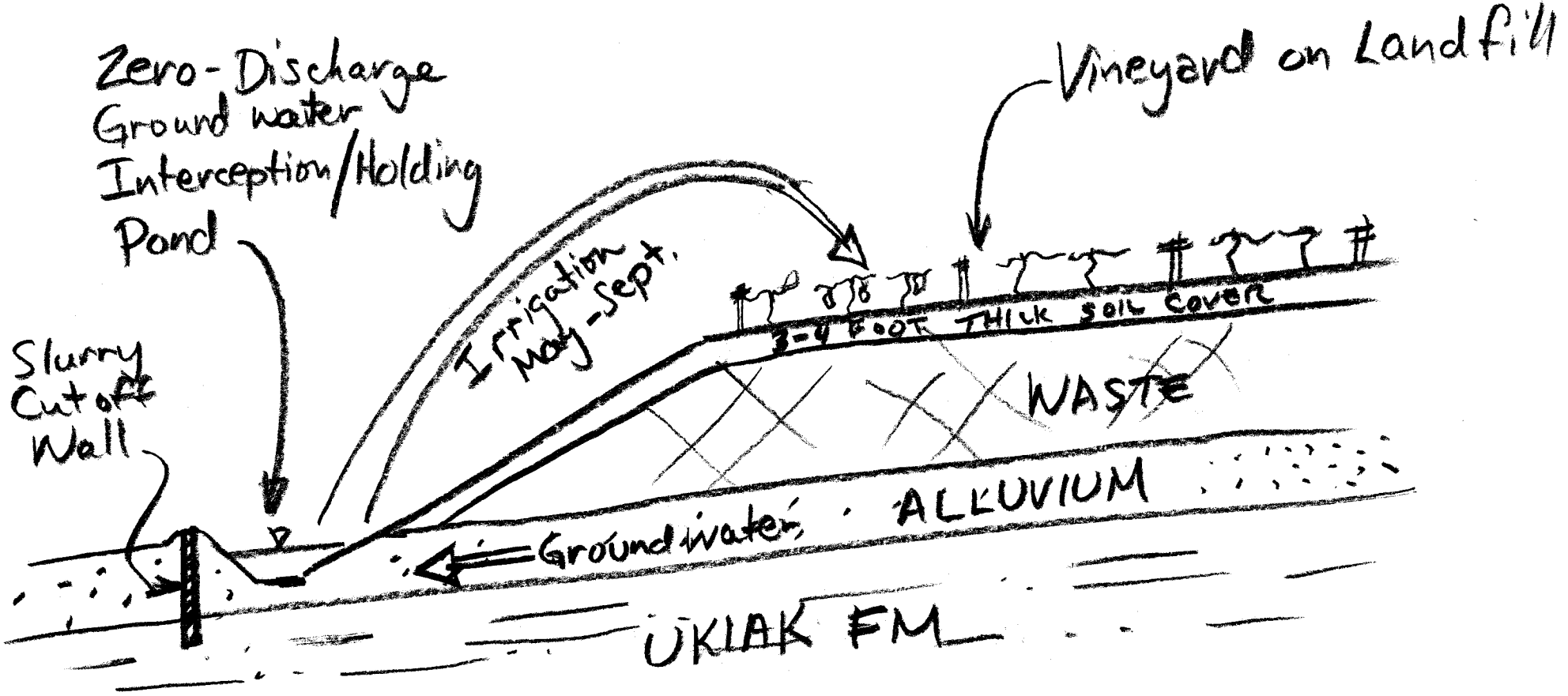

Figure 1. - Schematic of Engineered Alternative Landfill Cover