Rex Minerals Ltd

Water Management Plan

for the

Hillside Project

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1.0 Background

Water supply to the York Peninsula is derived from the Murray system. The current water demand for the Upper Paskerville system (which includes the Rex Minerals EL's) is 2750 ML/a which is projected to increase to 3600 ML/a by 2030 (SA Water Draft Long Term Water Plan). Supply is limited by the size of the supply lines and has been cited as a major factor limiting development on the Peninsula. In the area of Hillside the water main is relatively small at100mm in diameter and is required to supply the local farming sector with household and stock water as well as the coastal communities of Pine Point and Black Point. Connection of Black Point to the water main is relatively recent and since its connection has caused issues with water availability for the farming community during the peak holiday period.

Water requirements increase substantially in summer due to the influx of holiday makers and many of the water supplies in coastal settlements struggle to meet the increased demand.

Ardrossan Township uses around 140 ML/annum while smaller settlements like Pine Point consume around 80 ML/annum. Residential use in this area is generally in excess of 300 L/head/day. The current consumption of potable water by Rex Minerals at Hillside and other exploration targets is approximately 40 ML/annum which represents 50% of that used in Pine Point or the equivalent annual usage of around 90 residential households. In order to provide perspective this water consumption is similar to introducing 30 new commercial establishments into the Ardrossan - Pine Point area equivalent in size to a hotel/motel. Rex operations are a significant water user and it is probable that present water consumption by Rex makes it the single largest water consumer in the Ardrossan area. In the context of poor water supply dynamics to the Ardrossan – Pine Point – Black Point areas in summer it is likely that water supply to Rex will be constrained at this time and continued use of potable water by Rex for drilling will potentially create concern with the summer vacation community.

A recent farmers meeting highlighted additional issues related to the use of potable water in the drilling program. These included:

- The use of water tankers to supply water to the drilling sites has resulted in environmental damage related to tyre ruts, soil compaction and multiple access tracks which has been particularly obvious during the recent wet winter.
- Water wastage was noted at the loading hydrants with trucks occasionally overflowing.
- Lowering of water pressure (and even loss of water) in those residences close to the hydrant fill points.
- Lowering of water pressure which has resulted in stock troughs going dry during hot weather

The challenge for Rex is to develop a water strategy to minimize the use of potable water for drilling and therefore minimize competition for scarce water resources with the local community.

This plan details the management of water by Rex on Hillside to minimize the potential for conflict when using potable water and to reduce overall potable water use by using "fit for purpose" water derived from bores on the Hillside property and by maximizing the reuse and recycling of water. Not all aspects of the plan have been implemented but the plan has been adopted by Rex and will be implemented progressively as permits are obtained and equipment is procured and installed.

2.0 Water Management

2.1 Water Requirements

Water is required during the diamond drilling program for lubrication of the drill bit and removal of cuttings from the hole. It has been estimated that the annual requirement for water for the drill rigs is approximately 34 ML/annum. Water is recirculated through three 3000L tanks where drill cuttings gradually accumulate. The accumulation of sludge in these tanks requires, on average, the tanks to be pumped out each day. Sludge and water is removed by a vacuum pump truck and discharged to small holding dams on the Hillside property (Figure 1). Wet settled sludge generation from all the rigs operating is approximately 15 m^3/week. It should be noted that standard drilling practice is to dig in-ground sumps at every drill location and use these to contain the drill cutting sludge and clarify the water for reuse. In the case of Hillside this would have resulted in hundreds of drill cutting sumps which would have resulted in significant land disturbance (150m^2/drill site) and a substantial rehabilitation requirement. Rex have opted for the sludge tank system to minimise disturbance at each drill site and to consolidate all drill cutting sludge in one area to more easily manage waste and water recovery and to facilitate rehabilitation by concentrating land disturbance in one defined area.

Water use increases substantially if down-hole circulation is lost. Minimising water loss is a priority for the drillers and is initially attempted through the addition of reagents to drilling fluid which attempt to block off the areas of leakage. The hole can also be cased off to limit water loss but this is generally only feasible in the upper parts of the hole.

Assuming at least one diamond rig could encounter circulation problems each day and assuming 6 rigs are working a water requirement of around 100 kL/day is required. In addition to the water required for drilling, water is required for dust suppression during the drier months. Depending on the season this may extend for a period of up to 6 months and increase the water requirement by 40 kL/day (6000 kL/annum). The total water requirement is therefore up to 140 kL/day for the dry months January, February, March, April and December. The cooler wetter months will not require significant dust suppression resulting in an average water requirement of 115 kL/day. Average annual water use is approximately 40 ML/annum.

Figure 1: Existing Location of Drill Sludge Water Recovery Dams

2.2 Quality of Water Required

Discussions with the diamond drilling contractor indicate that they are able to effectively use a large range of water qualities when drilling. It was indicated that water qualities up to 200,000 mg/L salt were used as drilling water around Kalgoorlie. While this is not ideal, salt levels up too that occurring in sea water (40,000 mg/L) will not be a problem for the drillers and will not require the use of special drilling fluid reagents.

The issues with the use of relatively high saline water in the diamond drilling process will primarily be associated with preventing egress of this water from the drill pad as it would have a substantial detrimental impact on soil quality and agricultural production.

A preliminary survey of ground water on Hillside has shown that a brackish water lens (2000 mg/L – 10,000 mg/L) overlies more saline groundwater (16,000 mg/L - 28,000 mg/L). Water of these salinities is suitable for use in diamond drilling.

Water is also required for dust control. Highly saline water is unsuitable for this duty and around 40 kL/day of water (6000 kL/annum) with a salinity of less than 2000 mg/L will be required for dust suppression on roads and other operation areas.

2.3 Options for Water Supply

The following options are presented in the context of:

- Ensuring security of supply,
- Providing "fit for purpose" water,
- Recycling water from sludge recovery,
- Minimising environmental impact,
- Minimising the potential for conflict developing with other users,
- Minimising the cost to Rex,

The options for a source of water for Hillside Exploration are:

1. Potable Water derived from the SA Water main,
2. Ground Water
3. Runoff Water
4. Recovery and recycling of water

2.3.1 *Potable Water*

Continuing to use potable water at the existing rate of up to 120 kL/day is not desirable nor is it sustainable during the summer vacation period. However, potable water will still be required as a backup to ensure security of supply and may be required to minimize the potential impact of spills when drilling on land not directly owned by Rex. In this context reduced potable water use is likely to be acceptable provided it is managed to minimize the impact on other users of the water system.

From the beginning of the exploration program potable water has been supplied to the drilling rigs from a tanker which has tapped the main from a hydrant point. The tanker filling operation resulted in more than 130 L/min of water being extracted from the main for a period of 2 hours, up to five times per day. This caused some concern from the local farming community who has noticed a substantial drop in water pressure and water availability when the tanker is filling from the main. In order to minimise this impact by evening out the demand for water, a 3.5 km pipeline has been installed from the water main in Redding Road to Hillside project where it is connected to five 50,000L storage tanks (potable water storage 250 kL) (Figure 2). The storage tanks are located at the highest point on Hillside and the adjacent property on the north side of Curramulka Road where the water is reticulated via gravity to the drilling rigs through a central main 75mm in diameter. The water main is designed to supply 80L/minute (115 kL/day) to the project. However, discussions with SA Water after installation allowed only 60L/min (86 kL/day) provided that no impact was observed on other users of the system. Complaints were received from local farmers during the long and very hot weekend in January, and subsequent to this SA Water have restricted Rex's supply via the installed main to 25 L/min (36 kL/day). This represents 31% of the daily water required for operations.

SA Water have however, allowed the cartage contractor to continue to take 2 tanker loads per day from the same main in Redding Road. This represents 44kL/day which with the 36kL/day allowed along the Rex pipeline is equivalent to 56 L/min (close to the 60 L/min originally allowed by SA Water). While this does not seem logical it has allowed continued operations and represents a combined total of 69% of the water requirement of Hillside. Further water can be carted by the water contractor from a hydrant point at Muloowurtie approximately 16km west of Hillside. Generally this has contributed one or two loads per day (22kL – 44kL). This has been sufficient to maintain operations in the interim period. Rex recognizes that this rate of potable water use can only continue in the short term and alternative water supplies need to be developed. Rex is committed to limiting potable water use to the 25L/min allocated by SA Water to the project which will require additional water sources to supply the remaining 104 kL/day in the dryer months (79 kL/day in wetter months).

2.3.2 *Ground Water on Hillside*

RC drilling on Hillside has encountered water in many drill holes. In at least 40 drill holes water was sufficient to be noted on the logs and several produced sufficient water to require substantial quantities to be carted away. However, no records of the quantities carted have been kept which is unfortunate as this may have provided an indication of the potential quantity of supply.

Recent sampling to establish ground water quality was undertaken from 21st – 23rd September 2010. While limited time did not allow the sampling of all holes where water was encountered sufficient were sampled to enable a picture of the ground water quality to be obtained. The results of the sampling program are shown in Table 1.

Table 1: Water Quality in Hillside Drill Holes

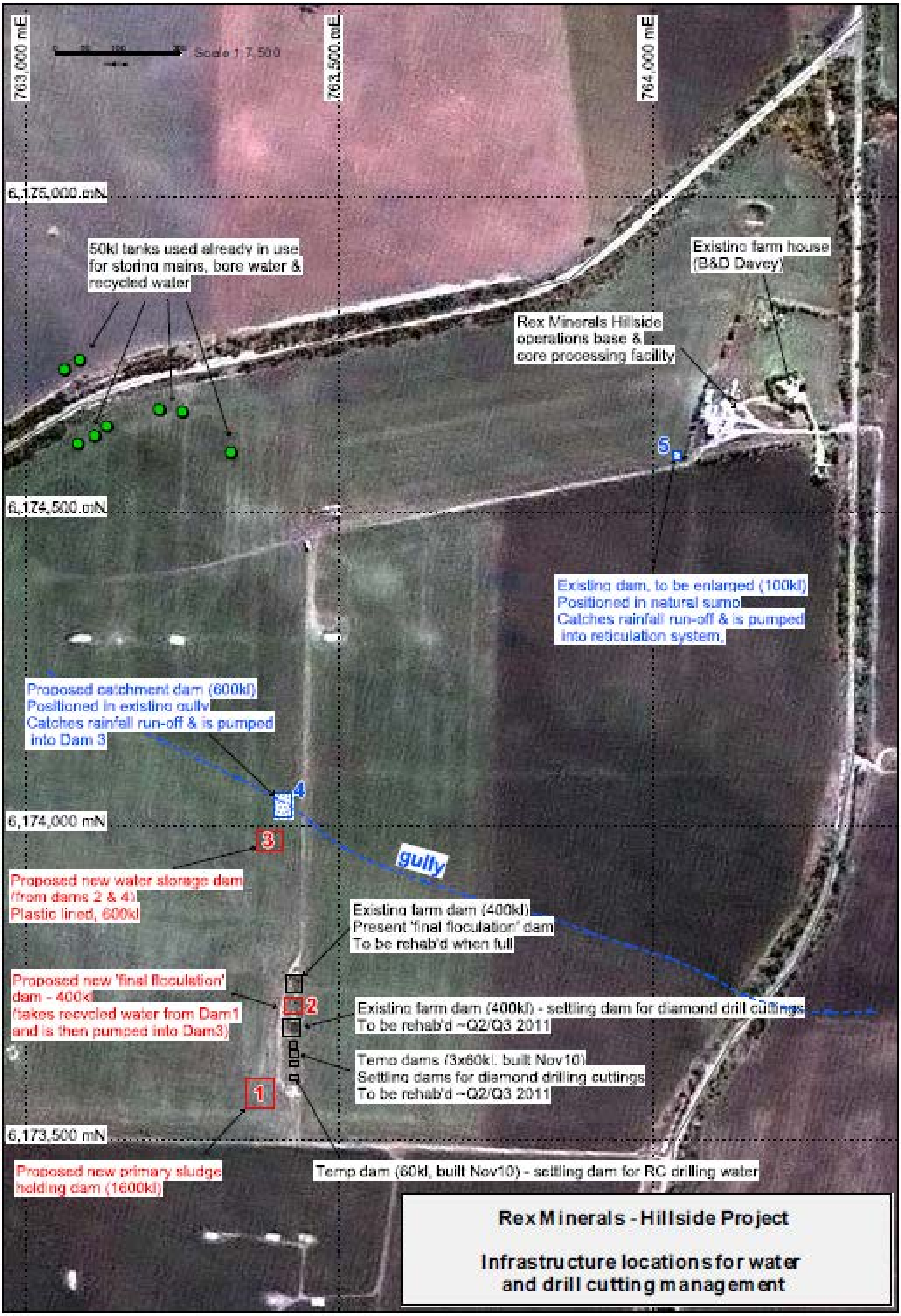
HRC Hole No.	Height above sea level (m)	Depth to water (m)	Conductivity (µS/cm)	Estimated Salinity (mg/L)
Hillside East of Pine Point Road				
109	23	23	3600	1780
107	28	9	12500	6220
106	33	Hole collapsed	-	-
104	37	25+ (hole partially collapsed, mud)	-	-
113	24	25	19470	9830
112	29	33	26000	13100
111	35	42	20500	10300
110	37	49	30300	15300
114	36	Hole collapsed	-	-

Hillside West of Pine Point Road				
080	46	Hole collapsed	-	-
081	44	No Water	-	-
039	42	Maybe water but > 50m deep	-	-
023	47	Cannot access hole with sample bucket	-	-
117	38	10	600	350
121	36	21	26000	12900
096	40	10	920	431
095	36	7	4300	2140
094	35	10	528	263
093	43	13	5720	2820
092	39	10	927	457
091	34	9.5	1780	889
001	44	Hole blocked by IP pipe		
003	35	Hole blocked by IP pipe		
004	39	Hole blocked by IP pipe		
084	46	16	1383	697
041	41	16	5120	2490
042	37	15	19600	9920
005	41	17	23800	9660
014	42	20	No sample	-
006	37	16	29100	14200
043	35	11	18850	9340
127	33	9	-	-
HWS 021	-	Sampled by Rex -	50800	31977
HWS 020	-	Sampled by Rex -	53400	31782
HWS 018	-	Sampled by Rex -	47900	29086
HWS 017	-	Sampled by Rex -	38000	26581
HWS 014	-	Sampled by Rex -	43700	29751
HWS 013	-	Sampled by Rex -	33800	26079
HWS 012	-	Sampled by Rex -	30400	25102

Water at shallow depths (10m – 15m) occurs in drill holes in and adjacent to the main gully crossing Hillside between 6,174,500 mN – 6,174,000 mN. Ground water in most other holes occurs at depths greater than 20m. Testing of water quality shows that a freshwater lens of very limited extent occurs in the gully with conductivities less than 1500µS/cm. The fresh water lens is underlain or transitions into a brackish water system which extends south from the gully for at least 500m. This water varies in quality with conductivities up to 26,000 µS/cm being recorded. This aquifer is likely to contain a considerably larger volume than the fresh water lens above. Below this brackish layer, conductivities continue to increase with depth and the limited records show that at least in the southern area of the deposit the conductivities of ground water at around the 30m below sea level approach that of sea water (50,000 – 60,000 µS/cm).

Several exploration holes for water bores have been drilled on the Hillside project area. These have generally shown that deeper ground water is structurally controlled and is primarily located within faulted crush zones within and around the ore body. Ground water recharge volumes have been found thus far to be relatively small within the ore body while in the major fault structures (Pine Point Fault) volumes are somewhat larger (although not particularly high).

Figure 2: Plan Showing the Location of the Water storage Tanks, Existing Water Dams and The Proposed Dams in the Upgrade Water Management System.



Two ground water bores have been developed (Figure 3), one in the Pine Point Fault (PPF) structure and one in the main gully crossing the deposit. The PPF bore has the potential to produce around 3.6kL/hour (86 kL/day) with a pH of 7.6 and a conductivity of 30 mS/cm. The bore in the gully has the potential to produce around 1.5 kL/hour (36 kL/day) at a pH of 7.3 and a conductivity of 15 mS/cm. Total potential bore water supply from the two bores is 122 kL/day. These bores will be equipped early in April 2011 and will pump bore water to two 50,000 litre storage tanks located adjacent to the potable water tanks at the high point on the Hillside property. These storage tanks are connected to the reticulation main and the bore water will be directed to the drilling rigs via the main.

Figure 3: Map Showing the Location of the Water Bores

2.3.3 *Runoff Water*

There are several small runoff catchment dams on the Hillside project area. However, even in the relatively high rainfall year of mid 2010 – 2011 little if any water was seen to accumulate in these structures.

Sandy topsoil over a clayey subsoil combines with relatively gently sloping topography on the Hillside project area to produce very limited runoff. Soils require considerable rainfall to reach fill capacity (around 25mm) and it is rare even in the coolest and highest rainfall months of May through to September to observe substantial runoff on the slopes and in the gullies draining the project area. Runoff tends to occur only after intense rainfall events which are highly intermittent. Nevertheless, these circumstances do occur and at these times dams sited to collect runoff could provide a useful source of water for the project.

Runoff can be significantly enhanced by compaction of the soil and this is clearly observed in the operations area/core farm and from the main access road. An existing small dam of approximately 100 kL collects runoff from the operations and core farm area (Figure 2) and this dam has been observed to fill after 25mm of rainfall. An examination of annual average monthly rainfall suggests that this small catchment system is likely to provide at least 1400 kL/annum over the months of April through to October. Intensive rainfall events occur outside these months and it is likely that in many years an additional 600 kL could be collected from this source. Significant runoff also occurs on the main access road through the centre of the farm. This runoff accumulates in the main gully crossing the project area and tends to cut the road after heavy rain. A conservative estimate of the water shed from the access road system indicates that around 2000 kL/annum will be available from this source.

The total water available from runoff is then conservatively around 4000 kL/annum and while this is an intermittent supply it will be extremely useful to substitute for mains water and for dilution of the bore water and recycled water to conductivities suitable for use in dust suppression.

To maximize the capture of runoff water the expansion of the dam in the operations/core yard and the construction of a new dam in the main gully are proposed. The existing dam draining the operations area has a volume of around 150 kL and this will be doubled in size with the excavated spoil used to raise the access road as this road regularly floods after heavy rain. The dam proposed for the main gully will be approximately 600 kL in volume with dimensions of 40m × 10m ×1.5m. The spoil from the borrow pit will be used to raise the access road to prevent flooding. Both these dams will be pumped into the water storage system when water is available to reduce losses through infiltration and evaporation.

Reference to the Northern and Yorke Regional NRM Plan shows that none of the Yorke Peninsula is included as a priority surface water area. Permits are therefore not required for the construction of water affecting activities such as dams or culverts. Design specifics of these dams are included in Appendix 1.

2.3.4 *Recovery and Recycling of Water*

2.3.4.1 Sources of Water

Cuttings from diamond/RC drilling are collected in the above ground tanks rather than in-ground sumps. This minimises the onsite environmental impacts at each drill site but necessitates the removal of accumulated sludge and water from the tanks using a vacuum truck. At Hillside approximately 9000L of sludge and water is removed from each rig on each day of drilling. This water and sludge is removed by a contractor and disposed to a series of dams located centrally on Hillside. The system is designed to capture the course quickly settled component of the drill sludge in dams with the overflow directed to a further settling dam where the fine sediment is flocculated and settled out. Clarified water is then pumped to the recycle tank from where it is presently used for dust suppression on the access roads on Hillside. A flow diagram of the existing process is detailed in Figure 4.

Water is also generated on occasion from the RC drilling rig. This generally occurs toward the end of the hole and is usually limited in extent by the fact that the sample becomes wet and drilling must stop. This water is always relatively saline and has been kept separate from the diamond drill water which at this stage remains fresh (< 600 mg/L salt) and is discharged into dam specifically designated for RC drill water and sludge. Since the construction of the small holding dam (60 kL) only 27 kL has been discharged into this dam. In future this water will be combined with the diamond drill water and recycled as the salinity of the recycled water will gradually increase as the contribution of ground water to the total water supply increases. At this stage however, maintaining a relatively fresh recycled water system allows reuse of all the recovered water for dust suppression on the roads.

2.3.4.2 Water Quality

To this stage potable water derived from the SA Water main has been used to supply the diamond drilling rigs. As a consequence salinity of the recovered water has remained below 600 mg/L (conductivity < 1300 µS/cm) with pH ranging from 7 – 8. Various organic based reagents are added to the drilling fluids and the residues of these are also present in the recovered water. The products most often used are based on vegetable oil and are quickly broken down by natural bacterial action, are not classified as hazardous and are unlikely to have a detrimental impact during drilling or reuse activities (Table 2). However, one additive used is based on mineral mixtures (eg. Fluidstar Stargel) which is classed as hazardous but not dangerous goods as it is a potential irritant to humans. Several other additives are based on organic polymers which are not classified as hazardous but which may break down less easily and may have a limited potential to leave residues (eg. Fluidstar LC Stop). The quantities of these products used are unlikely to result in a residue level that would have a negative ecological impact (Table 2).

Table 2: Summary of Drilling Fluid Additives

Fluidstar Product	Description	Hazard Classification	Ecological Impact	Regularity of Use
Deep Drill 5000	Emulsified Vegetable Oil Esters	Non-hazardous	Fully biodegradable	Moderately often
Biodegradable Hammer Oil	Hydro-treated Mineral Oil	Non-hazardous	No data	Regularly
LC Stop	Anionic Acrylic Copolymer	Non-hazardous	May impact on organisms at concentrations above 397 mg/L	Regularly
Liquid Supertrol	Polyanionic Cellulose	Non-hazardous	Not regarded as dangerous to the environment	Regularly
PAC HV	Cellulose Powder	Non-hazardous	Not regarded as dangerous to the environment	Not Often
Quick-Grout	Quick setting Cement	Non-hazardous	Avoid contaminating waterways	Often
Rapid Set	Controlled setting Cement	Non-hazardous	Avoid contaminating waterways	Often
Stargel	Mineral mixture including Smectite, Quartz, Feldspar and Kaolinite	Hazardous but not Classified as Dangerous Goods	No data	Regularly
Superfoam Plus	Sodium Alkyl Ether Sulphate and Formaldehyde	Hazardous	Avoid contaminating waterways/ classified as readily biodegradable	Occasionally used in RC Drilling
Tacky Daf	Mineral Oil & Alkali Metal Carboxylates	Non-hazardous	No data	Regularly
Universal	Vegetable Oil Esters	Non-hazardous	Fully biodegradable	Regularly

Assays of the core indicate that generally low levels of base metals and uranium occur within the ore body at Hillside. The metal in highest concentration is copper averaging 1364 mg/kg for the ore body (Table 3). All other metals concentrations likely to occur in the drill cuttings are below 50 mg/kg (Table 3). The metals occur as sulphide minerals at depth and carbonate and oxides at more shallow depths. The pH of the ground water is 7 – 8 and it is unlikely that in these conditions the base metals would become soluble to any significant degree. However, to confirm the levels of soluble metal in the returned drill water a regular monthly sampling program has been implemented. Samples have been taken to assess the concentration of these potential contaminants.

2.3.4.3 Sludge Quality

The source of the sludge is directly from drill cuttings. Drilling at the Hillside project consists of both diamond and RC drilling. Both drilling activities generate “sludge” and this sludge consists of cuttings, drilling fluids and water. Approximately, 15m^3 of wet semi-consolidated sludge is generated each week. Average concentrations of relevant elements within the drill cuttings are provided below (Table 3). The values presented below are derived from the weighted average of all sampled core/RC cuttings at Hillside, inclusive of ore and waste, and are considered to be a reliable proxy for the drill cuttings. When this data is compared to the National Environment Protection Measure (Assessment of Site Contamination) 1999 health investigation levels all values except for copper are well below the criteria for residential land and the PIRSA guidelines for uranium and thorium. However, as expected elevated levels of copper occur as the drilling target is a copper resource but even in this circumstance the copper levels are lower than the NEPM levels for land requiring investigation for parks, and secondary schools. In the circumstance where the drill cuttings are contained in clay lined or plastic lined dams it is unlikely that they pose a risk to the environment. Once the partially consolidated drill cutting sludge has dried sufficiently auger samples will be taken and a composite sample produced for analysis.

Table 3: Average Metal Values for the Ore body including Waste Zones

Element	Concentration	NEPM 1999 Investigation Levels for Residential, Accessible Soil, Day Care Centers, Primary Schools	NEPM 1999 Investigation Levels for Parks, Recreational Open Space, Secondary Schools
Cu (ppm)	1364.80	1000	2000
Zn (ppm)	49.75	7000	14000
As (ppm)	5.52	100	200
Cd (ppm)	0.23	20	40
Ni (ppm)	24.57	600	600
Pb (ppm)	10.96	300	600
		Radiation Protection and Control Act SA	
U (ppm)	22.81	>200ppm* is considered radioactive ore	
Th (ppm)	15.63	500ppm* is considered radioactive ore	

**Note: This definition will change with the adoption in South Australia of the Commonwealth’s National Directory for Radiation Protection in 2010/2011. The definitions will effectively change to 80 ppm uranium and 140 ppm thorium respectively*.

2.4 Existing Sludge Dams and Water Recycling System

The existing sludge storage and water recovery system has a present life of approximately 2 months. Before the end of June 2011 an upgraded system will need to be installed to allow continuing diamond drilling operations. The present system consists of two existing farm dams of approximately 400 m^3 and four smaller dams of approximately $60m^3$ each. These dams are all located part way up the slope which avoids the potential for inundation and all are surrounded by diversion banks to prevent the capture of runoff water.

The existing farm dams were located in a position that received very little runoff and were never observed to contain water in the period Rex have been working on the site (Figure 1). These dams were constructed in an area where a dense clay base has been observed which minimises infiltration. Before use, each dam was also lined with 0.5mm plastic to ensure that infiltration was minimised.

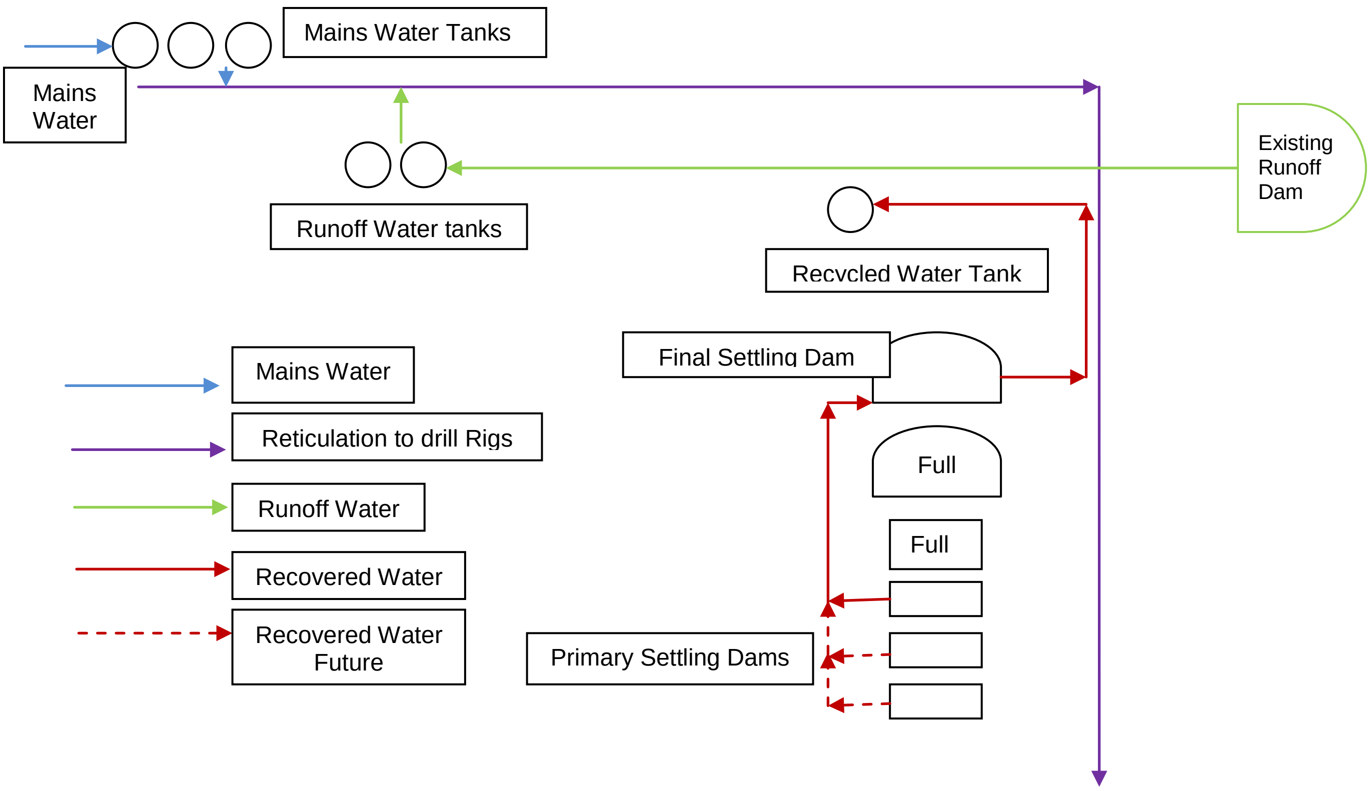
One of these dams is now full of drill cutting sediment and has been disconnected from the recycle water system to allow the sludge to dry out through evaporation. Once sufficiently dry the existing dam embankment clay based material will be used to cover the cuttings to a depth of at least a depth of one meter. The clay will be mounded to encourage runoff and track rolled to minimise infiltration. It will then be covered in topsoil and revegetated with pasture grasses.

The second of these dams is still in use and acts as the final flocculation/clarification dam (Figure 4) prior to the recovered water being pumped to the recovered water tank located on the northern high point of the Hillside property (Figure 2). At present, recovered water is used for dust suppression on the main access roads but it is proposed in the cooler months to incorporate this water into the main reticulation system supplying the drilling rigs. Settling is enhanced by the addition of Aluminium Sulphate (Alum) at a rate of 300 – 400 gm/kL which flocculates adequately but maintains pH at levels greater than 6.0.

Four smaller dams have been constructed to contain the coarser drill cuttings. These were designed to accommodate approximately 1 months of cuttings generation each. These are located higher up the slope from the old farm dam used for final flocculation to allow gravity discharge of the separated water. Each of these dams was constructed using a 12 tonne excavator to a depth of 1.5m in a location where a dense clay subsoil occurs which minimised the potential for water loss to groundwater. The spoil from the excavation was placed around all sides of the dams to prevent any runoff water entering the systems.

The first of these is now full of course cuttings and has been taken out of the circuit to allow drying of the sludge through evaporation. The remaining dams will be used sequentially for primary settling of the drill sludge. When full each will be separated from the water reclaim circuit and allowed to dry out by evaporation prior to covering with the clay excavated during construction. Sufficient clay is available to provide a minimum of 1m of cover and each will be mounded and then track rolled to ensure runoff water runs away from the dam system. Topsoil will then be reapplied and stabilised by seeding with pasture species.

Figure 4: Flow Diagram of the Existing Water Supply System



2.5 *Existing Water Balance*

Table 4 shows that at present the exploration activities are heavily reliant on water derived from the SA Water mains supply. Recovered water is presently used for dust suppression on the roads and runoff water is captured and substitutes for mains water when it is available. Recovered water is planned to be used as a substitute for mains water during the wetter months when the requirement for dust suppression is minimal.

Table 4: Existing Water Balance at the Hillside Exploration Project.

Source of Water	Daily Availability/allowance	Annual Availability	Comments
Direct From the SA Water main	36 kL	12 ML	
Water tankers delivered to site	66 kL	22 ML	Rex policy to find other sources of water and reduce tankered water to zero.
Recovered/recycled water	50 kL	16 ML	Used for dust suppression/substituted for mains water in wetter months
Runoff water	Up to 100 kL when available	2 ML	Substituted for mains water when available
Total Available Water	152 kL	52 ML	
Total Water Needed	140 kL (115 kL in wetter months)	40 ML	

3.0 *Proposed Improvements to Water and Drill Cuttings Management*

Rex has recognised that the ongoing use of a large quantity of mains water for drilling and dust suppression is unsustainable and has already resulted in issues with the local community. It is Rex's policy to minimise the use of mains water by developing other "fit for purpose" water supplies and maximising the recovery and reuse of water. Figure 5 describes the various water sources and the contribution of each to the overall water supply.

Two water bores have been developed which have the potential to generate in excess of 100 kL/day. These will be equipped in April prior to Easter which will enable the substitution of all mains water used in the drilling operation on the main Hillside property. Mains water will still be required for any exploration drilling on other properties as the salinity of the groundwater presents a risk to these farms should accidental spillage occur. The use of bore water on the Hillside project will reduce the impact of Rex on the SA Water main supply significantly and should alleviate those community issues associated with competition for a scare water resource.

Maximising the recovery of runoff water is another option which will allow substitution of mains water. To enable this to occur it is proposed to expand the existing small catchment dam located down-slope from the operations and core yard area and build a new dam in the main gully crossing the Hillside property (Figure 2). While it is recognised that this supply cannot be relied upon it has the potential to provide a significant contribution (estimated 4 ML/annum) to the overall water supply. The design details for the gully catchment dam are shown in Appendix 1. The nature of the soil in the gully is not conductive to the long term storage of runoff water. As a consequence it is proposed to pump the runoff water when it is available to a newly constructed HDPE plastic lined water storage dam higher up the slope. This dam will be 30m × 20m ×1.5m deep and store at least 600kL of water. Some of the water recovered from the drill cutting sludge settling system may also be stored in this dam. Design details are shown in Appendix 1. In summary the dam will be completely surrounded by a bund wall constructed from the excavated material. It will be HDPE plastic lined to minimise water loss and as recovered water may be stored it will include a leak detection system. The leak detection system will be based on plastic block drainage pads which will cover 10% of the base of the dam and will be located on the down slope side allowing collection of any water should a leak occur. The drainage blocks will discharge to an inspection well constructed of 150mm PVC.

After the completion of the drilling program the plastic liner will be removed and the dam refilled with the material borrowed and placed in the bund walls. The topsoil separated in the initial excavation will then be respread over the dam and stabilised with pasture species.

Installing a longer term drill cutting sludge management system is part of the long term water management strategy. At least 65% of the water in the drill sludge generated by each diamond drilling rig has the potential for recovery and recycling and maximising the use of this water is integral to the sustainable use of water on the Hillside project. Approximately 9000 litres of drill cutting sludge/water per rig per day is generated. It is expected that 6 – 8 diamond rigs will operate at Hillside for the next 2 years and these will generate 440 kL/week of sludge/water mix and after settling approximately 15 m^3 of semi-consolidated drill sludge per week.

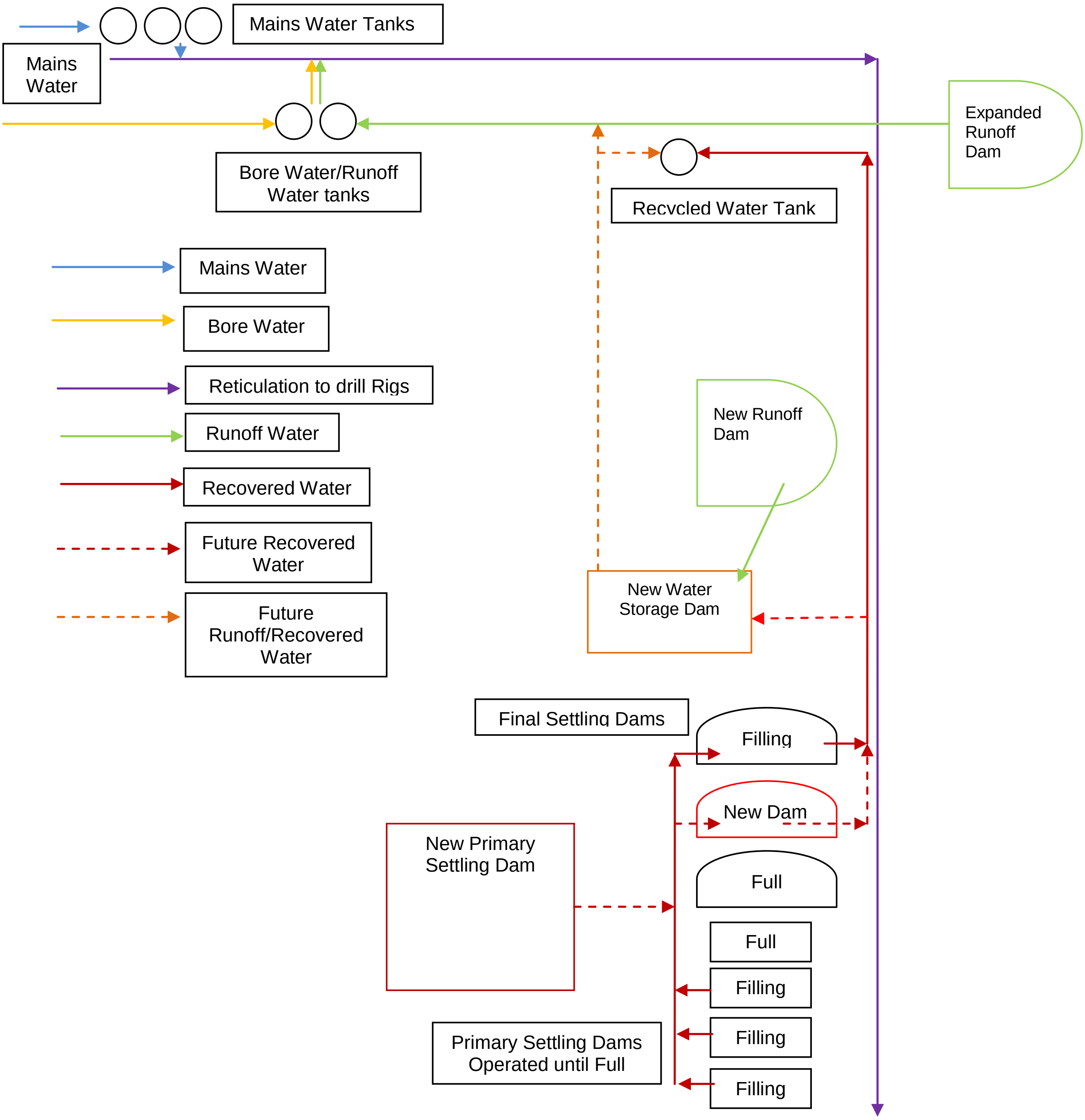
Settling and clarification of the sludge/water is expected to allow the recovery and reuse of a minimum of 290 kL/week of water. To enable this to occur a second flocculation settling dam is required. It is proposed to locate this dam between the two existing farm dams (Figure 2) to allow gravity flow from the proposed new primary settling dam and to the recovered water/runoff water storage dam (Figure 5).

The design details of this dam are shown in Appendix 1. In summary, the dam will have dimensions of 20m × 20m × 1.5m depth, it will be HDPE plastic lined (0.75mm thick) and will be encircled by a bund wall constructed of the excavated material to prohibit the collection of runoff. Alum at a rate of 300 – 400 gm/kL will be added to enhance flocculation. The dam will include a leak detection system. The leak detection system will be based on plastic block drainage pads which will cover 10% of the base of the dam and will be located on the down slope side allowing collection of any water should a leak occur. The drainage blocks will discharge to an inspection well constructed of 150mm PVC.

Fine sludge will collect over time and after completion of the drilling program this sludge will be left in place to dry out. Once sufficiently dry the plastic will be folded in and the whole system buried under a minimum of 1m of clay material derived from the bund wall system. This will be mounded and track rolled before application of topsoil and then stabilised by seeding with pasture species.

A primary settling dam large enough to accommodate the entire semi-consolidated sludge estimated to be derived from the 2 year exploration program is proposed. This dam will need a capacity of at least 1600 m^3 and it will be located near to the top of the slope. This will minimise any potential for the impacts of inundation and runoff and allow the gravity recovery of the partially settled drill cutting sludge water. Water from this system will be directed to the flocculation settling dam where final clarification will take place. The design characteristics of this system are shown in Appendix 1. The dam will have dimensions 40m × 40m × 1.5m deep and will be HDPE plastic lined (0.75mm). The methods of construction and final rehabilitation are similar to that summarised above for the final flocculation dam. The dam will include a leak detection system. The leak detection system will be based on plastic block drainage pads which will cover 10% of the base of the dam and will be located on the down slope side allowing collection of any water should a leak occur. The drainage blocks will discharge to an inspection well constructed of 150mm PVC.

Figure 5: Flow Diagram of the Proposed Water Supply System



3.1 *New Water Balance*

After installation of the proposed upgraded water management system the dependence on SA Water mains supply will be substantially reduced. Mains water will only be required for those drilling rigs working on exploration targets located away from the Hillside farm block and for dilution of the recycled water to then allow its use for dust suppression. Table 5 shows the projected water use on the Hillside property after the installation of the proposed dams and final equipping of the ground water bores.

Table 5: Projected Water Balance after Upgrading the Water Management System

Source of Water	Daily Availability/allowance	Annual Availability	Comments
Direct From the SA Water main	36 kL	12 ML	Used to dilute recovered water to reduce salinity to allow application on roads for dust suppression. Used for exploration off Hillside farm.
Water from Ground Water Bores	Up to 120 kL	Up to 40 ML	Used to supply diamond drilling rigs on Hillside farm. Ground water bores operated when required to maintain adequate water in storage
Recovered/recycled water	50 kL	16 ML	Used to supply diamond drilling rigs and for dust suppression on Hillside farm.
Runoff Water	Used when available	4 ML	Used as a substitute for mains water and to dilute recovered water for use in dust suppression when available.
Total Available Water	Up to 206 kL	72 ML	
Total Water Needed	140 kL (115 kL in wetter months)	40 ML	

Appendix 1: Dam Construction and Rehabilitation

A New Primary Settling Dam

A.1 Engineering/design

The design of the Primary Settling Dam is detailed in Figure 6 below. Initially all topsoil from the area will be removed and stockpiled for later use in rehabilitation. The dam borrow pit will then be excavated to 1.5m in depth. The batters will then be cut back to a slope of 2:1 using an excavator. The entire basin area will then be track rolled. Spoil will be removed to form a bund surrounding the entire dam and will be track rolled for consolidation. Once the dam is excavated it will be lined with a pre-made HDPE 0.75mm liner. Two 50mm PVC drainage lines will be installed into the liner at the original ground level to provide gravity drainage of the partially settled water to the final settling/flocculation dam located further down the slope. Leak detection will be incorporated below the HDPE liner. This will involve the installation of 160 m^2 of plastic inter-connecting drainage blocks located along the down slope side of the basin floor. These drainage blocks will be laid over a track rolled (partially consolidated) floor and a HDPE 0.3mm liner. They will extend for the full 40m and will be 4m in width. The drainage blocks will discharge to a plastic lined inspection sump accessed via a 150mm PVC pipe.

A.2 Soil Characteristics

The soil consists of a sandy loam topsoil of 300mm which is underlain by dense clay with occasional bands of calcrete nodules to at least 2m depth.

A.3 Maintenance of the facility

The site land manager will have primary responsibility for managing the water supply system. This will involve daily inspections of the dams to determine if works are required and to ensure that water levels in the systems are maintained at an appropriate level. Free-board of 0.3m will be maintained at all times.

A.4 Monitoring of the facility

Daily inspections will be conducted by the land manager. This will include monitoring of the leakage detection inspection sump.

A.5 Depth to water table

The depth to the water table in the area of the proposed construction is greater than 20 meters. The quality of the ground water in this area is saline and slightly basic in pH.

A.6 Risk management strategy

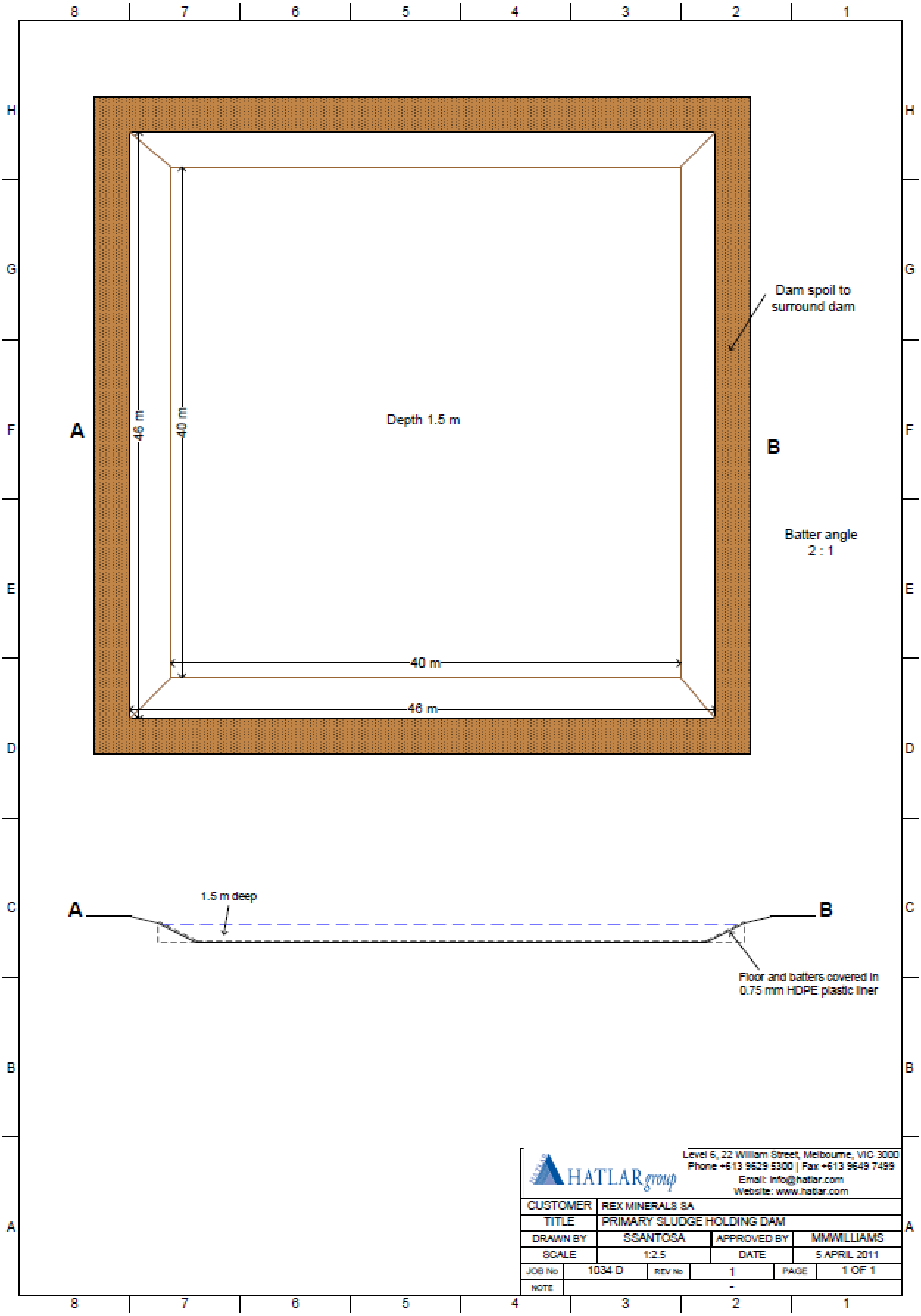
The Primary Settling Dam will be located at the top of the hill which will minimise the potential for inundation. It includes a bund of at least 1 meter high surrounding the entire dam basin which will prohibit runoff water entering the system. Direct rainfall will enter the system and this will be incorporated into the partially settled recovered water and transferred through the drainage pipes to the final settling/flocculation dam. The positioning of the drainage pipe will limit the water level in the dam. Regular inspections of the drainage pipe will ensure they are not blocked and that over-topping of the dam will not occur. The drill cutting sludge and water discharged into the dam will be contained within a 0.75mm plastic liner which overlies dense track rolled clay subsoil. This will minimise any potential impact on groundwater which is itself saline. The installed leak detection system will quickly indicate if the liner integrity has been compromised.

A.7 Rehabilitation Strategy

The coarse drill cuttings will accumulate in the dam at a rate of approximately 15m^3 per week. Once the dam is full then the semi consolidated sludge will be left to partially dry out through evaporation. Once sufficiently dry to support surface activities the sludge will be carefully augured to obtain a representative composite sample for analysis. It is expected that these analyses will indicate that the levels of contaminants will remain below the relevant NEPM investigation levels. In the unlikely event that the contaminants in the sludge do not meet the required standards then the sludge will be removed and stabilised using a standard stabilisation procedure (magnesium oxide/cement/fly ash mix) prior to being redeposited back into the dam. Rehabilitation of the dam will then proceed as follows:

1. The liner is folded in over the semi-dry sludge.
2. The clay containing batters are then pulled back over the sludge to establish a mound to facilitate drainage and all sludge is covered to at least 1 meter in depth.
3. The clay cap is then track rolled to minimise infiltration.
4. The topsoil saved in the original excavation is then recovered and spread over the clay cap.
5. Stabilisation of the topsoil is obtained by seeding with pasture species commonly used in the area.

Figure 6: New Primary Settling Dam Design



B New Final Settling/Flocculation Dam

B.1 Engineering/design

The design of the Primary Settling Dam is detailed in Figure 7 below. Initially all topsoil from the area will be removed and stockpiled for later use in rehabilitation. The dam borrow pit will then be excavated to 1.5m in depth. The batters will then be cut back to a slope of 2:1 using an excavator and the entire dam excavation will then be track rolled. Spoil will be removed to form a bund surrounding the entire dam and will be track rolled for consolidation. Once the dam is excavated it will be lined with a pre-made 0.75mm HDPE liner. Two 50mm PVC drainage lines will be installed into the liner at the original ground level to provide gravity drainage of the clarified water to the water storage dam. A pump will also be installed to directly supply the recovered water tank. Leak detection will be incorporated below the HDPE liner. This will involve the installation of 40 m^2 of plastic inter-connecting drainage blocks located along the down slope side of the basin floor. These drainage blocks will be laid over the track rolled (partially consolidated) floor and a HDPE 0.3mm liner. They will extend for the full 20m and will be 2m in width. The drainage blocks will discharge to a plastic lined inspection sump accessed via a 150mm PVC pipe.

B.2 Soil Characteristics

The soil consists of a sandy loam topsoil of 300mm which is underlain by dense clay with occasional bands of calcrete nodules to at least 2m depth.

B.3 Maintenance of the facility

The site land manager will have primary responsibility for managing the water supply system. This will involve daily inspections of the dams to determine if works are required and to ensure that water levels in the systems are maintained at an appropriate level. Free-board of 0.3m will be maintained at all times.

B.4 Monitoring of the facility

Daily inspections and monthly water sampling will be conducted by the land manager.

B.5 Depth to water table

The depth to the water table in the area of the proposed construction is greater than 20 meters. The quality of the ground water in this area is saline and slightly basic in pH.

B.6 Risk management strategy

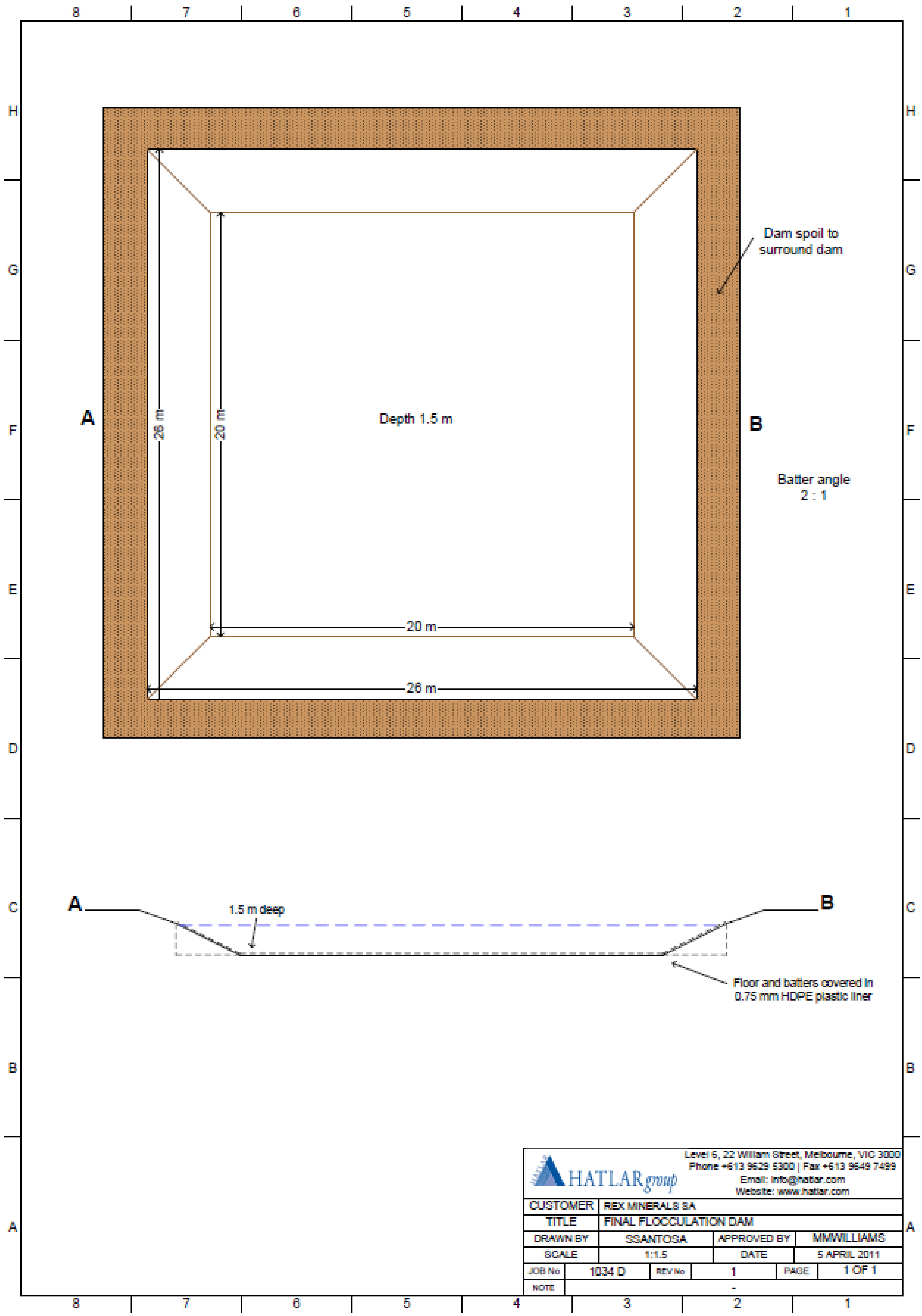
The final Settling/flocculation Dam will be located between the two existing farm dam part way down the slope. This will minimise the potential for inundation. It includes a bund of at least 1 meter high surrounding the entire dam basin which will prohibit runoff water entering the system. Direct rainfall will enter the system and this will be incorporated into the recovered water and transferred through the drainage pipes to the recovered water tank or the water storage dam. The positioning of the drainage pipe and regular pumping will limit the water level in the dam. Regular inspections of the drainage pipe will ensure they are not blocked and that over-topping of the dam will not occur. The fine settled drill cutting sludge and water discharged into the dam will be contained within a 0.75mm plastic liner which overlies dense clay subsoil. This will minimise any potential impact on groundwater which is itself saline. The installed leak detection system will quickly indicate if the liner integrity has been compromised.

B.7 Rehabilitation Strategy

The fine sludge will accumulate in the dam and once the dam is full then the semi consolidated sludge will be left to partially dry out through evaporation. Once sufficiently dry to support surface activities the sludge will be carefully augured to obtain a representative composite sample for analysis. It is expected that these analyses will indicate that the levels of contaminants will remain below the relevant NEPM investigation levels. In the unlikely event that the contaminants in the sludge do not meet the required standards then the sludge will be removed and stabilised using a standard stabilisation procedure (magnesium oxide/cement/fly ash mix) prior to being redeposited back into the dam. Rehabilitation of the dam will then proceed as follows:

1. The liner is folded in over the semi-dry sludge.
2. The clay containing batters are then pulled back over the sludge to establish a mound to facilitate drainage and all sludge is covered to at least 1 meter in depth.
3. The clay cap is then track rolled to minimise infiltration.
4. The topsoil saved in the original excavation is then recovered and spread over the clay cap.
5. Stabilisation of the topsoil is obtained by seeding with pasture species commonly used in the area.

Figure 7: New Final Settling/Flocculation Dam Design



C New Water Storage (Runoff and Recovered Water)

C.1 Engineering/design

The design of the Water Storage Dam is detailed in Figure 8 below. Initially all topsoil from the area will be removed and stockpiled for later use in rehabilitation. The dam borrow pit will then be excavated to 1.5m in depth. The batters will then be cut back to a slope of 2:1 using an excavator. An area centrally located will be left raised by 0.5 meters to act as the base for the filter wall. Spoil will be removed to form a bund surrounding the entire dam and will be track rolled for consolidation. Once the dam is excavated it will be lined with a pre-made 0.75mm HDPE liner. Leak detection will be incorporated below the HDPE liner. This will involve the installation of 60 m^2 of plastic inter-connecting drainage blocks located along the down slope side of the basin floor. These drainage blocks will be laid over the track rolled (partially consolidated) floor and a HDPE 0.3mm liner. They will extend for the full 30m and will be 2m in width. The drainage blocks will discharge to a plastic lined inspection sump accessed via a 150mm PVC pipe.

Rock filled gabions will be installed to act as a filter wall on the raised section of the floor. A pump will be installed to allow the supply of water to either the bore water/runoff water tanks or the recycle tank.

C.2 Soil Characteristics

The soil consists of a sandy loam topsoil of 300mm which is underlain by dense clay with occasional bands of calcrete nodules to at least 2m depth.

C.3 Maintenance of the facility

The site land manager will have primary responsibility for managing the water supply system. This will involve daily inspections of the dams to determine if works are required and to ensure that water levels in the systems are maintained at an appropriate level. Free-board of 0.3m will be maintained at all times.

C.4 Monitoring of the facility

Daily inspections will be conducted by the land manager.

C.5 Depth to water table

The depth to the water table in the area of the proposed construction is greater than 15 meters. The quality of the ground water in this area is saline and slightly basic in pH.

C.6 Risk management strategy

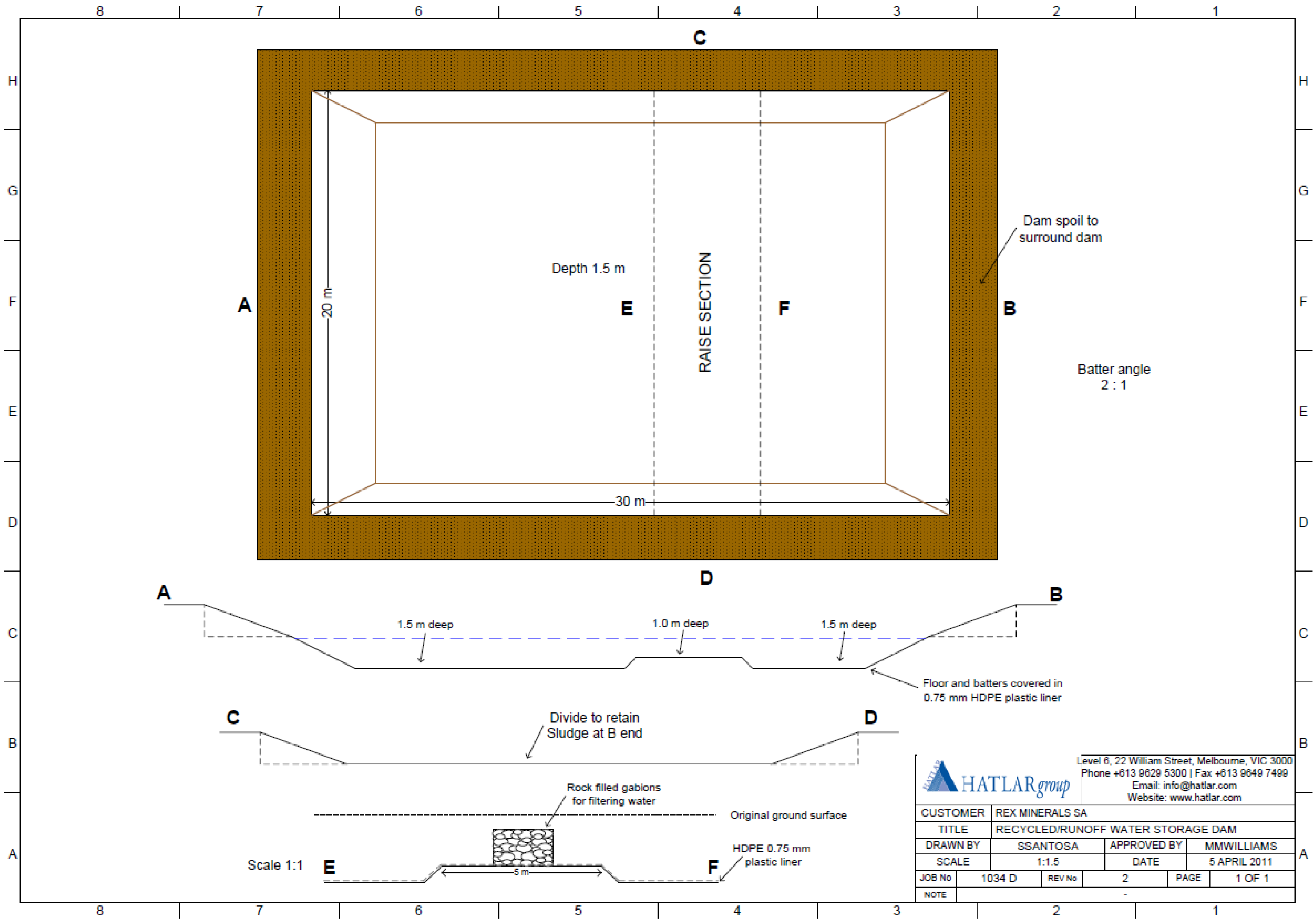
The Water Storage Dam will be located low down on the slope but several meters elevation above the valley floor. This will minimise the potential for inundation. It includes a bund of at least 1 meter high surrounding the entire dam basin which will prohibit runoff water entering the system. Direct rainfall will enter the system and this will be incorporated into the water supply system. Regular pumping will limit the water level in the dam and regular inspections will ensure that over-topping of the dam will not occur. Any fine settled drill cutting sludge still remaining in the recovered water and sediment entrained into the runoff will be contained within a 0.75mm plastic liner which overlies dense clay subsoil. This will minimise any potential impact on groundwater which is itself saline.

C.7 Rehabilitation Strategy

It is expected that little or no sludge will accumulate in this system and what does will be generally inert. Rehabilitation of the dam will proceed as follows:

1. The liner is removed from the dam and disposed to landfill.
2. The clay containing batters are then pulled back to fill the excavated area. The excavated area is slightly mounded to allow for natural settling.
3. The topsoil saved in the original excavation is then recovered and spread over the clay cap.
4. Stabilisation of the topsoil is obtained by seeding with pasture species commonly used in the area.

Figure 8: New Water Storage Dam



D New Runoff Water Collection Dam

D.1 Engineering/design

The design of the Runoff Water Dam is detailed in Figure 9 below. Initially all topsoil from the area will be removed and stockpiled for later use in rehabilitation. The dam borrow pit will then be excavated to 1.5m in depth. The batters will then be cut back to a slope of 2:1 using an excavator. Spoil will be removed to form an embankment on the down-slope side. This embankment will form part of the main access road. Flood overflow will be accommodated in six 150mm PVC pipes which will be located at the original ground level and pass through the raised embankment. A pump will be installed to transfer collected runoff to the water storage dam.

D.2 Soil Characteristics

The soil consists of a sandy loam topsoil of 300mm which is underlain by a somewhat more porous sandy-clay with occasional bands of calcrete nodules to at least 2m depth.

D.3 Maintenance of the facility

The site land manager will have primary responsibility for managing the water supply system. This will involve daily inspections of the dams to determine if works are required and to ensure that water levels in the systems are maintained at an appropriate level. Free-board of 0.3m will be maintained at all times. Water levels will be controlled by the level of the drainage pipes and regular pumping to the water storage dam.

D.4 Monitoring of the facility

Daily inspections will be conducted by the land manager.

D.5 Depth to water table

The depth to the water table in the area of the proposed construction is greater than 10 meters. The quality of the ground water in this area is fresh to slightly brackish and slightly basic in pH.

D.6 Risk management strategy

This dam is designed to maximise the capture of runoff water most of which will be derived from the compacted surfaces of the main access roads. As soon as a sufficient depth of water has collected to allow the float valve to float the pump will be started and water will be transferred to the water storage dam. This will minimise the potential for a breach of the dam wall. Such a potential breach will also be minimised by keeping the dam empty between rainfall events and by ensuring the overflow pipes are unobstructed.

D.7 Rehabilitation Strategy

It is anticipated that this water dam will be left in place should the Hillside project not proceed to a mining phase. Should rehabilitation of the dam be necessary then it would proceed as follows:

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1. The clay containing batters are then pulled back fill the borrow pit.
2. The topsoil saved in the original excavation is then recovered and spread over the clay cap.
3. Stabilisation of the topsoil is obtained by seeding with pasture species commonly used in the area.

Figure 9: New Runoff Water Collection Dam