Sunnyside Cogeneration Associates

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SCA #2 Ash Landfill
DEQ Construction Permit Submittal

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Permit Application Report
SCA #2 Ash Landfill
Groundwater Permit No. UGW070002

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Note: Appendix documents A, B, C, D & E are included with the Groundwater Permit Application Documents. They are noted here by reference.

Design drawings have been updated for the Construction Permit and are included herewith.

1.0 Introduction

The Sunnyside Cogeneration Associates (SCA) power plant burns waste fuel and provides dozens of jobs, both directly through plant operations, and indirectly through contractor positions and suppliers. SCA supplies electric power to the local power grid and is a major tax contributor to the local area. SCA is part of the overall mining and energy production industry which is an essential part of the local, state and global economy. Continued operation of SCA brings important social and economic benefits to the area. Removal of the waste fuel left behind by others through the past decades of mining in the area results in an efficient use of natural resources and reclamation of the existing refuse piles. Operations occur in a manner which protects air quality, surface waters and groundwater in the region. Ash is a byproduct of the SCA power plant and SCA has been disposing of this ash at the SCA #1 Ash Landfill a short distance west of the power plant since plant began operations in the early 1990's.

The Sunnyside Cogeneration Associates #2 Ash Landfill is a new ash landfill to be constructed on private property owned by SCA in an area approximately 1 mile to the south east of the SCA power plant. This report presents descriptions, rationale, analysis, and design computations for the engineering features of the SCA #2 Ash Landfill. This engineering report is part of a permit application package for the SCA #2 Ash Landfill.

2.0 Executive Summary

The proposed SCA #2 Ash Landfill is located in unincorporated Carbon County (Section 8, Township 14 South, Range 14 East, SLB&M) just south of the city of Sunnyside. Approximate location of the landfill is Latitude 39° 32' 24" North and Longitude 110° 22' 50" West. County zoning for this area allows for this use and Carbon County has granted a Conditional Use Permit for the SCA #2 Ash Landfill.

The proposed SCA #2 Ash Landfill is to be constructed in a small side canyon. This location was selected because it

- has a significant amount of existing disturbed area from a prior land owner,
- does not have regular surface water flows,
- is closer to the power plant and will reduce material haul distances, and
- will reduce the potential for dust near local residences.

Sediment traps and a clay lined sediment pond (#18) are proposed with the SCA #2 Ash Landfill to control storm water runoff from the landfill.

The plan, as submitted herewith, includes capacity for up to 3.6 Million cubic yards of ash material to be placed within a landfill footprint of approximately 34 acres with a maximum material thickness of 170 feet above existing ground (approximately 375 feet from the toe to the top of the landfill). Based on an average of 300,000 cubic yards per year, the landfill could serve for approximately twelve years. If the annual material placement quantity is less, the landfill could serve for a longer time.

Ash will be placed in a terrace-and-bench configuration. Terraces will be a maximum of 60 feet in height with an approximate 3 horizontal to 1 vertical slope above and below each bench. Each terrace will be set back a minimum of 15 feet from the previous terrace to form a bench. The geotechnical engineer's stability calculations for SCA#2 allowed for slopes as steep as 2:1 with terraced benches every 60 feet in elevation. SCA has chosen to build with gentler slopes to maintain a conservative approach and reduce the potential for erosion.

SCA's ash includes a significant percentage of limestone which is added to the combustion process for SO2 control. The SCA ash material has pozzolanic properties and tends to harden over time in the landfill, thus increasing mass stability and reducing the potential for leachate generation.

Initial landfill development consists of constructing a new sediment pond #018, the lower sediment trap #1, lower perimeter ash containment/conveyance ditches, storm water run-on prevention berms, and an access road turnaround for the trucks.

Periodic access roads will be constructed over time as part of landfill development. The upper sediment trap #2 and additional upper access routes will be constructed at a later time as the lower portion of the ash landfill nears that elevation.

Cover soil will be placed on finished ash surfaces and vegetation will be established to minimize erosion and percolation of rainfall into the ash. Cover soil will be placed as often as needed as part of routine reclamation operations. Seeding, fertilizing, and mulching of the cover soil will be performed in the Fall.

3.0 Geotechnical Evaluation

This section presents the results of a geotechnical evaluation completed by Professional Service Industries, Inc. (PSI) in April 2012. The purpose of the geotechnical evaluation was to

- characterize the subsurface profile of the site,
- evaluate the global and local slope stability of the proposed ash landfill,
- evaluate existing groundwater conditions and
- provide geotechnical recommendations regarding erosion control and construction considerations for the proposed ash landfill.

A summary of findings from the geotechnical report is included here. For more information we recommend a review of the full report (See Appendix C).

3.1 Site Description

The SCA #2 Ash Landfill encompasses approximately 34 acres in a small side canyon with existing elevations ranging from approximately 6400 to 6775. The site is underlain by colluvial and alluvial deposits. The surface includes vegetated areas as well as gravel, rock and boulders with steeper areas showing significant rock outcroppings.

3.2 Field Investigation

Two borings were completed at the proposed site. B-1 was completed to approximately 50 feet near the bottom (west) of the proposed fill. A permanent monitor well (MW8) was installed in the borehole to observe groundwater. B-2 was drilled to a depth of 33 ½ feet near the upper east area of the proposed site. Samples and boring characteristics were analyzed from each bore hole.

Four exploratory test pits were excavated to observe the near-surface soil conditions and depth to the bedrock.

PSI conducted Refraction Microtremor (ReMi) testing along three profile line arrays within the proposed site. This testing uses standard seismic refraction equipment. The waves measured were used to assist in differentiating between the overburden soil deposits and underlying bedrock. This assisted in determining approximate depth to bedrock at various locations across the site in between borings and test pits.

3.3 Laboratory Testing

Laboratory tests were completed on samples of soil and the SCA ash material to evaluate physical and engineering properties. Tests included direct shear, unconfined compressive strength, moisture-density relationship, and sieve analysis. A summary of the lab test results is shown on the following table.

Material Description	Water Content (%)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Internal Friction Angle (Φ)	Gradation		
					Gravel (%)	Sand (%)	Silt/Clay (%)
Sandy Silt (ML)	9	-	-	-	13	32	55
Silty sand with gravel (SM)	5-7	-	-	-	26-35	32-38	33-38
Silty gravel with sand (GM) / (GP-GM)	2-5	-	-	-	40-76	15-30	9-31
Bulk combined ash sample from stockpile	-	88	24	32	2	50	48

3.3.1 Strength Tests

Given the cohesive strength developed in the compacted ash due to the pozzolanic properties of the ash, unconfined compressive strength tests were performed on three moisture conditioned cylinder samples. After drying, the samples were broken and the unconfined compressive strength of the ash material was found to be in the range of 5,760 - 6,910 psf. Effective Shear Strengths and Unit Weights of the different soils were determined as follows:

Description of Soil	Unit Weight of Soil, pcf		Effective Shear Strength	
	Moist	Saturated	C' (psf)	ϕ'
Ash	80	85	800	32
Silty gravel with sand (SM) (GM)	120	125	0	34
Gravel with silt, sand and cobbles (GP-GM)	140	145	0	38
Shale bedrock	150	155	25,000	0

3.4 Subsurface Conditions

The subsurface soil and bedrock observed generally consist of alluvial and colluvial materials (silty sands with gravel and silty gravel with sands) underlain by lean clays and sandy silt with cobbles and boulders. The soils are underlain by a relatively impervious layer of shale bedrock. The depth to the shale bedrock varied from approximately 14 to 50 feet below existing grade. Standard Penetration resistance, N-Values, ranged from approximately 32 to greater than 50 blows per foot in the overburden soils and greater than 50 blows per foot in the shale bedrock.

3.5 Groundwater

Groundwater was encountered in boring B-1 at a depth of approximately 20 feet below existing grades. Groundwater was not observed in boring B-2 or the exploratory excavations during the drilling/excavation operations. Groundwater is expected to remain 10 feet or more below the ground surface in the vicinity of the landfill and not anticipated to come into contact with any ash materials. Similarly, the groundwater is expected to remain perched atop the shale bedrock as it moves in a general northeast to southwest direction.

SCA has conducted groundwater sampling and analysis at the monitor well MW-8 set by PSI in boring B-1 (Approximate Latitude 39° 32' 18" North and Longitude 110° 23' 04" West.) This sampling and analysis occurred between January 31, 2012 and January 29, 2013. Results of the analysis are included in Appendix A. These results represent the pre-construction or baseline conditions for groundwater in the area. The analysis shows groundwater high in TDS and many of the Cations and Anions. Generally, these results are common for groundwater conditions in contact with the Mancos Shale formations.

SCA would have preferred to install an up-gradient monitoring well for the purpose of monitoring groundwater conditions prior to reaching the landfill area. However, since this site was selected due to its location at the head of the small side canyon (to reduce the potential for storm water and near surface groundwater) the uphill cliff topography of the site also does not allow for access to an up-gradient location. The lack of groundwater observed in B-2 near the upper portion of the landfill area supports the expectations for little to no groundwater at a higher elevation. Access routes on the top of the mountain are a considerable distance away from the area and not likely to be representative of the groundwater reaching this area.

Given that the areas above the landfill area were not accessible, SCA would like to request a variance from the traditional up-gradient well or source.

3.6 Stability Analysis

Ash material placement at the SCA #2 Ash Landfill will be accomplished in a similar manner to the SCA #1 ash landfill. Ash will be placed above the existing alluvium/colluvium slopes in lifts, moisture conditioned and compacted. Based on the existing site topography, subsurface evaluation, geophysical study (ReMi), site reconnaissance and other information from available geologic maps, cross sections were developed for use in the slope stability analyses. Various cross section options were evaluated to model long term global stability of the overall landfill design, the intermediate stability during construction and to evaluate the local shorter term stability of the ash benches that will be used throughout the construction phases of the landfill.

The PSI Geotechnical Report (Appendix C) provides substantial detail and explanation of the modeling and calculations performed for various conditions. A summary of the results of these calculations is outlined below:

Global Long Term Stability Analyses (a minimum factor of safety of 1.2 is recommended)

Description	Geotech Cross Section	Method	Factor of Safety
Global Stability block failure mode (static)	E-E	Simplified Janbu	2.9
Global Stability block failure mode (pseudo-static)	E-E	Simplified Janbu	2.4
Global Stability circular failure mode (static)	E-E	Modified Bishop	3.0
Global Stability block circular mode (static)	E-E	Modified Bishop	2.5

Intermediate Stability Analysis (a minimum factor of safety of 1.2 is recommended)

Description	Geotech Cross Section	Method	Factor of Safety
Intermediate Stability block failure mode (static)	Intermediate Section 1	Simplified Janbu	3.5
Intermediate Stability block failure mode (pseudo-static)	Intermediate Section 1	Simplified Janbu	2.7
Intermediate Stability block failure mode (static)	Intermediate Section 2	Simplified Janbu	3.1
Intermediate Stability block failure mode (pseudo-static)	Intermediate Section 2	Simplified Janbu	2.5

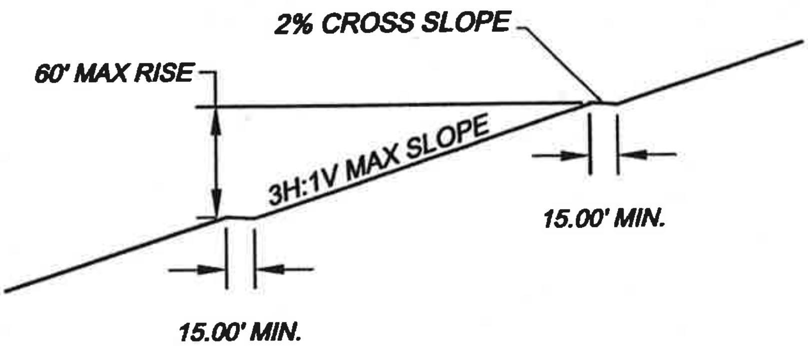
Short Term Stability Analysis (Ash benches)
(Minimum factors of safety of 1.5 static and 1.2 pseudo-static conditions are recommended)

Description	Cross Section Slope (Ash Bench)	Bench Height (ft)	Method	Factor of Safety
Short term stability circular failure mode (static)	2H:1V	60	Modified Bishop	2.1
Short term stability circular failure mode (pseudo-static)	2H:1V	60	Modified Bishop	1.8

3.7 Design Parameters

After reviewing the recommendations from the PSI Geotechnical Engineering Report, SCA has determined the following design parameters for the SCA #2 Ash Landfill:

- 3H:1V slope on the face of the landfill
- Benches/Terraces 15 feet wide at a maximum vertical spacing of 60 feet
- Drainage Collection ditches on each bench/terrace with the ditch profile slope generally in the range of 1-2%. Drainage will be directed to perimeter collection ditches, through erosion control BMP's and sediment traps and then into a clay-lined sediment pond.



TYPICAL FILL SECTION

In an effort to be more conservative and provide for a greater factor of safety in the design, SCA is using a design slope of 3H:1V on the face of the landfill instead of the steeper 2H:1V slope that the geotechnical engineer has determined to be allowable. SCA recognizes the variability that may occur in construction and has chosen this gentler slope to provide flexibility and a level of tolerance in the construction conditions. A construction tolerance will allow segments with slopes up to 2.5H:1V without re-grading, but all areas that inadvertently end up steeper than 2H:1V will be re-graded.

SCA also expects that this gentler design slope will give the project a greater stability, reduced risk of erosive conditions and improved conditions for reclamation.

3.8 Settlement Analysis

The placement of ash on the alluvium is likely to cause settlement of the alluvium. The geotechnical analysis of the site indicates that, given the granular nature of the overburden and ash materials, consolidation settlement and secondary compression have been determined to be negligible. Immediate settlement is calculated with the soil behaving as a linear elastic material. Settlement is estimated to be on the order of 6 to 8 inches. Settlement of the material should occur relatively quickly after initial placement. Thus the majority of expected settlement should occur during construction as the ash materials are placed.

The magnitude of expected settlement (even if it was double the estimated amount) is tolerable during construction and operation of the SCA #2 Ash Landfill.

3.9 Summary of Geotechnical Conclusions

The conclusions of the PSI geotechnical evaluation are summarized in the following paragraphs.

Water: While ground water was not observed in Boring B-2 (upper east slope) or in any of the test pits, ground water was observed in Boring B-1 at the lower west end of the site. No surface waters were present at the site or within the near proximity of the site. The granular surface soils (ranging from approximately 14 to 50 feet thick) on top of the relatively impervious shale bedrock will provide an adequately porous layer to convey any ground water that does migrate under the proposed ash landfill. Any migrating ground water is expected to move in a general northeast to southwest direction atop the shale bedrock and at least 10 feet below the ground surface in the vicinity of the landfill and not come into contact with the ash materials.

Leachate Evaluation: PSI recommends placement of a 6-inch thick low permeability soil cap on top of the completed landfill with a native soil cover above that for re-vegetation. Surface water should be controlled to reduce the potential for erosion or ponding and observed erosion conditions should be repaired. Providing these recommendations are followed, PSI anticipates that the risk of water percolating through the ash material and into the groundwater is minimal.

Structural Stability: PSI conducted several structural stability analyses for the proposed landfill in various possible configurations ranging from bench heights of 30 ft. and cross slope section of 1.5H:1V up to a bench height of 60 feet and cross slope section of 2H:1V. All of the configurations modeled indicated short term and long term safety factors greater than the minimums recommended per ASTM E 2277-03 "Standard Guide for Design and Construction of Coal Ash Structural Fills" and also in accordance with the guidelines presented in USACE Manual EM 1110-2-1902 "Slope Stability".

Settlement: PSI recommends that ash materials be placed in maximum 12-inch lifts and with proper compaction; the expected settlement occurring in this landfill will have minimal impact.

Site Suitability: Based on the results and recommendations of their study, PSI is of the opinion that the site of the proposed SCA#2 ash landfill is suitable from a geotechnical engineering perspective.

4.0 Soil Cover Design and Reclamation

SCA has gained successful reclamation experience over the past 20 years and benefitted from the collective experience of the Utah coal mining community. SCA's proposed soil cover is based on this experience and is designed to both minimize water percolation in contact with the ash materials and to promote successful re-vegetation and erosion control. The following principles have influenced this design:

- Precipitation in the area ranges from 10 inches to 20 inches per year
- Evapotranspiration in the area can range from 20 inches to 35 inches per year
- Seeding with a mixture of properly selected species can establish a good vegetative cover to reduce erosion, reduce weeds, maintain natural conditions and extract water from the soil cover layer.
- Mixing a weed free straw or hay mulch along with fertilizer into the upper soil cover layer provides added nutrients in the soil cover without making it immediately available for weed growth.
- Placement of the soil cover in a roughened state can reduce erosion gullies by capturing precipitation in small pockets rather than allowing it to run down the slope. These pockets are also effective at assisting initial vegetation growth.
- A layer of low permeability soil beneath the vegetative soil cover can reduce the potential for soil moisture to come into contact with the ash materials

Given the principles above, SCA proposes the following soil cover design:

- Cap the landfill with a 6 to 8-inch layer import soil material. SCA has developed a practice at the SCA #1 Ash Landfill for placing and compacting this soil cap and will continue to follow this practice on the SCA #2 Ash Landfill. This includes importing clean soil material (2-inch minus with relatively high percent fines). Place and spread this material across the surface of the slope, moisture condition and compact with a small dozer, making two passes.

- Place a native soil layer for vegetative growth (average 18 to 24-inch loose thickness)
    - The proposed native soil will be tested to confirm appropriate fertilizer and mulch amendments. Given the experience with native soils in this area, it is expected that soil amendments may include something like the following:
        - Spread fertilizer over the soil cover at a rate of up to 200 lb./acre 16-16-8 fertilizer (slow release) or equivalent
        - Depending on the organic content of the native soil, SCA may choose to spread up to 1.5 ton per acre of certified weed free straw mulch.
        - Mix the above noted fertilizer and mulch into the top 12-18 inches of soil utilizing any efficient and effective method (some options include scarifying, plowing, track hoe pocketing, etc.) and
        - Leave the slope surface in a roughened condition to reduce erosion potential (typical 4"-8" deep pockets)
- Seed with reclamation seed mix currently being used on SCA's Sunnyside properties, hydro-seeded with 1.5 tons per acre wood fiber much and tackifier.

5.0 Leachate Potential

Extensive modeling for and evaluation of leachate potential has been prepared in connection with the design of the SCA #1 Ash Landfill located a short distance to the west / north west of this site. (For more information, please refer to Appendix D which includes the modeling reports of the SCA #1 Ash Landfill). The SCA #1 Ash Landfill was designed with a 16" soil cover and no base liner. Surface water is directed around and off of the landfill and contained in lined sedimentation ponds. The different phases of the SCA #1 Ash Landfill have been in operation and / or closure during the past 20 years. Regular monitoring of ground water and surface water in the area confirms the results of the modeling which indicated no significant impacts to ground water were expected.

Given the proposed soil cover for the SCA #2 Ash Landfill described above, the pozzolanic properties and low hydraulic conductivity of the ash, the dry conditions at the selected site, the proposed surface water controls and the proposed lined sediment pond: the proposed design of the SCA #2 Ash Landfill, with no base liner, 6-8 inches of compacted soil cap and 18-24 inches of vegetated native soil cover, will not result in groundwater quality impacts beyond limits established by the State of Utah. The potential for leachate discharge to occur during the active and post-closure phases of the SCA #2 Ash Landfill is negligible.

5.1 Sediment Pond #018 Liner

Sediment Pond #018 will be lined with a low-permeability barrier layer to minimize infiltration of ash-contact runoff which is captured in the pond. The proposed liner design involves either a native clay layer or soil/bentonite mixture.

A native clay material liner would consist of screened import material (2-inch minus), spread and compacted in place. The liner would be 12 inches thick, compacted in two 6-inch lifts to 95% with a resultant hydraulic conductivity less than or equal to $1x10^{-5}$ cm/s.

A soil / bentonite mixture would consist of screened native soil (2-inch minus) and granular bentonite (minus-40 mesh) blended in specific proportions (minimum 6 percent – dry weight basis), moisture conditioned to above-optimum moisture content, and spread and compacted in place. The liner would be 8 inches thick, compacted to 95% with a resultant hydraulic conductivity less than or equal to $1x10^{-5}$ cm/s.

Given the sediment traps proposed up from the Sediment Pond #018, it is expected that the sediment accumulation in #018 will be significantly reduced and regular sediment cleaning will occur more in the sediment traps and less in #018. Nonetheless a 6-inch protective layer of native soils (screened material 2-inch minus) will be placed on top of the liner with detecta tape placed at 3 to 5 foot intervals between the liner and the protective layer.

5.1.1 Proposed Hydraulic Conductivity Testing

Prior to placing the pond liner, construction methods will be reviewed with a geotechnical lab and simulated with the actual material to be used for the liner (either the actual native clay material or the proposed mixture of bentonite/soil). It is proposed that hydraulic conductivity of the liner be determined by preparing two samples using the proposed material and methods and performing falling head conductivity tests in accordance with ASTM D 5084 on the samples. Upon verification that the proposed material and methods will meet permeability requirements, the construction would proceed with field tests to verify compaction.

6.0 Surface Water Controls

This section presents the analysis and design of the surface water control features for the SCA #2 Ash Landfill. The governing principals behind the surface water controls for this landfill are to collect and divert runoff via terrace ditches to the perimeter collection ditches. This water is detained briefly in sediment traps to slow the flow rate and drop sediments prior to reaching the lined sediment pond #018. Straw bales or other bmp's will be placed periodically in the perimeter collection ditch to further assist in slowing the flow velocity and reducing the potential erosion. SCA has submitted a permit application package to the Utah State Engineer for approval to build Sediment Pond #018 (See Appendix E).

Runoff calculations are based on the concept that the ash terraces will be covered as described above on a periodic basis such that the entire ash landfill is not exposed at the same time. This will allow the re-vegetation efforts to establish a reasonable ground cover and minimize runoff and erosion for the project.

6.1 Existing Surface Water Features

As previously stated, the location for the SCA #2 Ash Landfill was selected in part due to the absence of water sources in the area. This site is not located in a 100 year flood plain and only ephemeral surface water features exist in the near vicinity. The site is located in the upper headwaters area of Icelander Creek. Icelander Creek is normally dry near the site but often has extended seasonal flows below Whitmore Springs located approximately 1.5 miles to the west / northwest of the site. Water Canyon is located approximately 0.5 miles to the south of the site and typically only sees storm related or snow melt related runoff. Grassy Trail Creek is located approximately 0.8 miles to the north / northwest and usually experiences flow during seasonal runoff conditions and releases from the upstream dam.

6.2 Hydrologic Data

The rainfall point values for the Sunnyside and East Carbon, Utah area were obtained from the NOAA Atlas 14, Volume 1, Version 5. The 24-hour rainfall values used are 1.99 inches for the 10-year event and 2.83 inches for the 100-year event.

Runoff was estimated using the Rational method and hand computations. Assuming Type I antecedent moisture conditions for the site, the runoff coefficient was estimated at 0.65 for exposed ash conditions, 0.25 for surfaces that have been recently covered with soil and roughened, and 0.15 for surfaces that have been re-vegetated in a roughened condition.

The direct tributary drainage area to Sedimentation Pond #018 is approximately 55 acres. The designed sediment traps 1 and 2 together with straw bales and other bmp's will slow the peak flow velocities in the ditches and reduce the sediment load, but overall, the total volume of water delivered to #018 is the same. These sediment traps have been factored into the hydrologic modeling.

Pond and sediment trap design details, watershed boundaries, flow paths, pond connectivity, diversions, ditches, and calculations are shown in the Appendix B to this report and the accompanying drawing package (Appendix F).

Runoff from most areas outside the landfill footprint will generally be diverted away from the sediment pond using diversion berms and ditches on the landfill perimeter.

6.3 Design Assumptions

When the SCA #2 Ash Landfill development is in progress, the tributary drainage area to the sedimentation pond will consist of a combination of existing ground in undeveloped areas, exposed ash on active terraces and benches of the active cell, and cover soil on closed benches. Existing ground in undeveloped areas of the site consists of a coarse alluvium in a relatively dry condition. Runoff from these areas will generally either be diverted away from the landfill or be collected with the landfill runoff and flow to the sediment pond.

Ash surfaces in the active cell tend to be in a somewhat dry condition after exposure to the evaporative conditions typical of the area. Benches in the cell will be sloped inward to prevent runoff from cascading down the terrace faces as an erosion-prevention measure. Runoff from the top of the terrace will drain to perimeter ditches or terraces and be conveyed to the sediment traps and pond. Cover soil on closed portions of the landfill will also tend to be in a relatively dry condition, and will be sloped and roughened as described in the reclamation section above.

As expected, runoff computations indicate that the greatest runoff volume is generated from exposed ash surfaces. In order to produce a conservative pond design volume (on the side of oversizing), the pond was design to contain the runoff volume projected and then the two main sediment traps were added. While it is anticipated that the sediment traps will remain open and drain slowly through the discharge pipe, it is possible to temporarily close the discharge pipe valve and hold the storm water to avoid a discharge from sediment pond #018. The UPDES permit will allow a discharge from #018 as long as the discharge is tested and meets the required water quality standards.

6.4 Hydrologic Modeling Analysis Results

Based upon computations using the Rational method, the 100-year 24-hour event will produce approximately 2.3 acre feet of runoff in a final reclaimed condition. The 10-year 24-hour event will produce between approximately 1.0 and 3.0 acre feet, depending on the condition of the landfill construction at the time of the storm (amount of the landfill constructed, extent of exposed ash surface, sediment traps, etc.). Calculation summaries are included in Appendix B.

Sediment Pond #018 is designed with a capacity of approximately 2.5 acre feet, below the 18" overflow discharge standpipe. Discharge capacity through the standpipe is as much as 13 cfs. While it is possible to envision two major storms occurring in a short time period (with a combined precipitation greater than the design storm), it is expected that there will be no discharge during most years.

Sediment Trap #1 is designed with a capacity of approximately 1.6 acre feet below the 24" overflow discharge standpipe. Discharge capacity through the standpipe is as much as 18 cfs, but it is expected that most storms will be smaller than 1.6 acre feet and will therefore simply drain this sediment trap through the 2" drain pipe at flow rates less than 0.3 cfs. Discharge from Sediment Trap #1 will flow directly to Sediment Pond #018.

Sediment Trap #2 is designed with a capacity of approximately 1.4 acre feet below the overflow discharge spillway ditch. Discharge capacity over the spillway can be as much as 15 cfs, but it is expected that most storms will be smaller than 1.4 acre feet and will therefore simply drain this sediment trap through the 2" drain pipe at flow rates less than 0.3 cfs. Discharge from the Sediment Trap #2 drain pipe will flow to a terrace ditch and into the south perimeter collection ditch which will flow to Sediment Trap #1 and then to Sediment Pond #018. If Sediment Trap #2 fills and discharges through the overflow spillway, it will follow ditches on SCA property into SCA's Borrow Area Pond #016 which, if it ever discharges, would end up into Sediment Trap #1 and then Sediment Pond #018.

6.5 Ditch Conveyance and Erosion Control

This section discusses erosion control for runoff control ditches at the SCA #2 Ash Landfill. Ditches flowing across the terraces and around the perimeter of the landfill will not generally be lined. The minimum ditch grade at the landfill is approximately 1 percent—there is little chance that excess ponding will occur in any ditches. The ponding area of the sediment pond #018 will be 100-percent lined, as described above. Ash contact runoff may wet the soil in the ditch invert, but will tend to quickly evaporate in the arid climate rather than infiltrate.

Flow velocities in the terrace ditches will generally be high enough that little sediment deposition will occur. Therefore any ash which may erode from the landfill will be deposited in the sediment traps or the lined sediment pond. Ash and sediment will be routinely excavated from the traps and pond and placed into the active ash cell.

The north and south perimeter ditches are sloped much greater than terrace ditches. They will have periodic bmp's (such as straw bales, silt fences or other check dams) to reduce the risk of serious bed erosion in the ditch. If significant amounts of sediment build up behind the bmp's, maintenance will be required to ensure the continued functionality of the ditch and bmp.

As an alternate to bmp's described above, SCA may determine that it is more efficient to place rock armoring in the ditches to control erosion. Gravel and cobbles obtained from screening cover soil can be placed along the ditch invert. Some fines will initially wash away (to the sedimentation trap), leaving a natural graded armor layer. SCA may also choose to install additional small sediment traps, or other bmp's, at the site to manage flow rates.

7.0 Construction QA / QC Plan

It is in the best interest of SCA to ensure proper construction of the sediment pond, sediment traps, storm water bmp's, ditches, terraces, ash placement and reclamation cover. SCA will oversee its contractors and be responsible for requiring proven construction means and methods from them. Verification of proper material placement and compaction will include a variety of testing:

A. Sediment Pond and Sediment Traps
    a. All sites to receive fill material placement shall be Cleared and Grubbed. This shall include removal of all organic matter from the site. Approximately 12" of topsoil, roots, and other organic matter shall be removed. Topsoil should be salvaged and placed on the final surface prior to re-vegetation. Large organic matter may be chopped and spread across re-vegetation areas.

b. Import material for dike construction or clay liner

   i. A minimum of two gradation sieve analyses shall be obtained from the import source. Random spot observation during delivery and spreading shall verify that no organic or oversized material is received.

   ii. A minimum of two modified proctor tests shall be obtained from the import source. Proctor tests shall be performed on the actual material to be provided and shall occur no more than 30 days prior to material delivery. On site compaction shall be compared to the average of the two proctors.

c. Compaction

   i. Moisture conditioning shall be performed to bring fill materials within +/- 2% of optimum conditions as determined for the material being placed.

   ii. Dike core construction shall occur in 8"-12" lifts and include compaction by heavy construction equipment common to the area. A minimum of 95% compaction shall be required. A minimum of two compaction density tests shall be performed on each lift prior to placing the subsequent lift.

   iii. Clay liner construction shall occur in two 6" lifts and include compaction by heavy construction equipment common to the area. A minimum of 95% compaction (or greater if required by geotechnical lab hydraulic conductivity tests for the material being placed) shall be required. A minimum of one compaction density tests per 3000 sqft shall be performed on each lift prior to placing the subsequent lift. (It is anticipated that approximately 13-15 in place tests will be performed for the clay liner on Pond 018.)

   iv. Cover soil placed over the clay liner shall occur in one 6" lift and include compaction by heavy construction equipment common to the area. A minimum of 90% compaction shall be required. A minimum of three compaction density tests shall be performed on the cover material placed on Pond 018.

v. Additional fill material placed over the dike to achieve design slopes shall occur in maximum 12-16" lifts and include compaction by heavy construction equipment common to the area. A minimum of 90% compaction shall be required. A minimum of one compaction density tests shall be performed on each lift prior to placing the subsequent lift. No compaction shall be required for topsoils placed on the surface.

B. Ash Material Placement

a. All sites to receive ash fill material placement shall be cleared of all vegetation. Topsoil (if any) should be salvaged and placed on the final surface prior to re-vegetation. Large organic matter may be chopped and spread across re-vegetation areas.
b. SCA has developed a program for ash material placement that includes spreading ash material in 6"-8" lifts, moisture conditioning and compacted by a grader with a hydraulic compaction roller. This is done with at least two passes.
c. SCA has designed the SCA#2 Ash Landfill with the intent that the outer slope will average 3H:1V. Periodic survey measurement will occur on each terrace/lift. If any significant portions of the lift have a slope steeper than 2.5H:1V, they shall be re-graded.
d. SCA has designed the SCA#2 Ash Landfill with the intent that the elevation change from one terrace to the next shall not exceed 60 feet, and that the profile slope for the terrace ditch shall average 1%-2% slope. Terrace benches are intended to have a minimum 2% cross slope into the hill to keep storm water from spilling over the bench. Periodic survey measurement will occur on each terrace/lift. If any significant portions of the terrace are higher than 60 feet, they shall be re-graded. If any significant portions of the terrace ditches are less than 0.5% or steeper than 3.5% slope, they shall be re-graded. (Perimeter ditches are designed with steeper slopes and shall be constructed on native soil – not over ash material- and include regular bmp's for velocity control).

C. Reclamation Soil Cover

a. Either import or native soils may be used for cover material, provided they meet the intended purpose.

b. A 6" – 8" soil cap (2"minus with relatively high percent fines) shall be placed over the ash material. Compaction shall include two passes with the dozer. No in place density tests shall be required.

c. An 18" – 24" loose layer of reclamation soil shall be placed over the soil cap and roughened in place. Tests for vegetative parameters will be performed for each material source to confirm the appropriate amount of fertilizer and mulch to be added.

d. Random pothole verification shall be performed to observe the depth of soil placed. Approximately 3-4 potholes per lift shall be dug.

8.0 Operation / Maintenance Plan

SCA will operate and maintain the SCA #2 Ash Landfill in accordance with the requirements of the Groundwater Permit.

Closure will include covering and re-vegetation as described above. The SCA #2 Ash Landfill would be considered closed after the soil cover is complete and the landfill has been reseeded.

Post Closure monitoring will occur for 10 years following the point of closure and will include semi-annual inspections to observe the success of re-vegetation, check for erosion problems, and sample the monitoring well MW-8. Maintenance of the site may require attention to re-vegetation or erosion needs. Water monitoring will verify that groundwater conditions are still within protection limits set in the Groundwater Permit. The Post Closure period would be considered complete when ten years following closure have past, re-vegetation efforts have resulted in conditions similar or better than the surrounding area, and surface soils are stabilized (erosion conditions do not present a risk of exposing the ash material).

9.0 Contingency and Corrective Action Plan

SCA will operate and maintain and monitor the SCA #2 Ash Landfill in accordance with the Operation and Maintenance plan described in Section 7.0 throughout the operational, closure and post closure periods.

During these time periods, it is possible that conditions could arise which require corrective action. SCA has developed a plan to address the potential conditions as follows:

- Erosion Gullies – It is possible that erosion gullies could develop on the face of the landfill or in the drainage channels. The likely cause of this condition is from a large storm event or many smaller events over time. Corrective action would be site specific but would focus on controlling surface water runoff, slowing the velocity, redirecting to a stable area and / or filling the gully and re-establishing vegetation.
- Slumping or mass movement of ash or other soil materials – Although the proposed slopes are more conservative than required by the geotechnical engineer, in the event of mass movement, SCA would re-evaluate the stability of the slope in that area and re-grade as necessary to achieve a stable slope.
- Water Quality
    - Surface Water – The state UPDES permit will specify the required quality of surface water discharges from this site. SCA will monitor the UPDES point as required by the permit. In the event that discharges exceed the quality standards, SCA will evaluate and implement the best management practices needed to stay in compliance. Some options may include increased pond or sediment trap capacity; additional ponds, sediment traps or other bmp's; increased re-vegetation efforts to reduced sediment and runoff; etc.
    - Ground Water – SCA will monitor the groundwater quality at MW-8. Given the conditions of the site and the ash material, ground water impacts from the ash landfill are not likely. Nonetheless, if SCA experiences monitoring results that exceed the protection limits, it will take measures to verify the test results, determine the cause of the higher results and implement efforts to reduce potential impacts from the ash landfill (i.e. increased soil cap, additional water diversions, etc.).