UPDATED RUN-ON / RUN-OFF CONTROL SYSTEM PLAN

ASH LANDFILL AREA

SPRINGERVILLE GENERATING STATION

SPRINGERVILLE, ARIZONA

Prepared for

Tucson Electric Power Company

October 14, 2021

Prepared by

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Project No. 1062.07

AMTECH

Updated Run-On / Run-Off Control System Plan
Ash Landfill Area
Springerville Generating Station
Springerville, Arizona

I certify that the material and data in this Updated Run-On/Run-Off Control System Plan were prepared under the supervision and direction of the undersigned and meets the requirements of 40 CFR §257.81.

AMTECH Associates, L.L.C.

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Registered Professional Engineer (Environmental)
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CONTENTS

1 INTRODUCTION

AMTECH Associates L.L.C. (AMTECH) has prepared this Updated Run-on/Run-off Control System Plan for managing stormwater at the ash disposal landfill (Ash Landfill) area associated with the Springerville Generating Station (SGS) operated by Tucson Electric Power Company (TEP). This plan was prepared to comply with run-on and run-off control system requirements as per the U.S. Environmental Protection (EPA) Agency's Standards for the Disposal of Coal Combustion Residuals (CCR) in Landfill and Surface Impoundments, 40 CFR §257.81 (EPA, 2015). These standards are applicable to the facility's Ash Landfill as an "Existing CCR landfill" as defined in §257.53.

An initial run-on and run-off control system plan was completed on October 14, 2016, for the existing Ash Landfill, as per §257.81(c)(3). This updated run-on and run-off control system plan for the Ash Landfill was completed on October 14, 2021, as per §257.81(c)(4).

1.1 Regulatory Requirements

As per §257.81(a), the owner or operator of an existing CCR landfill must design, construct, operate, and maintain: A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

As per §257.81(b), run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.

As per §257.81(c), an initial and periodic run-on and run-off control plan for the CCR Unit must be prepared by the timeframes specified by §257.81(c)(3) and (4). Section 2 of this document contains the Updated Run-On and Run-Off Control System Plan for the Ash Landfill.

1.2 Site Description and Location

The SGS is a four-unit, pulverized coal-fired, steam electric generating facility, operated by TEP that began operations in 1985 and consists of a combined net generating output of approximately 1600-megawatts.

SGS is located approximately 15 miles northeast of Springerville, in Apache County, Arizona. The power plant area of SGS is located in Sections 27, 28, 33, and 34, of Township 11 North, Range 30 East of the Salt and Gila River Baseline and Meridian. The SGS site occupies 15,777 acres, which includes the power plant area, Ash Landfill area and the east and west well fields.

The Ash Landfill, which is located southwest of the power plant area, is primarily used for the disposal of fly and bottom ash, any permitted waste derived from the coal-fired units at the plant. A delineated portion of the Ash Landfill is used for the disposal of other items in lesser quantities, i.e. reactivator sludge, construction debris and power plant outage refuse, sump sludges, demineralizer resins, (Petroleum Contaminated Soils (PCS), not exceeding Arizona residential soil remediation levels, cooling tower sludge, lime, soda ash, sewage pond sludge, evaporation pond solids, miscellaneous pond clean-outs, cooling tower treated lumber, and other inert and non-hazardous materials. TEP is authorized to dispose of these materials in the Ash Landfill under its Aquifer Protection Permit (APP) No. P-101448. The Arizona Department of Environmental Quality (ADEQ) is the regulating authority for the APP Program.

2 INITIAL RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

2.1 Content of the Plan §257.81(c)(1)

This Run-on and Run-off Control System Plan documents how the run-on and run-off control systems have been designed and constructed to meet the applicable requirements of §257.81 and is supported by appropriate engineering calculations derived in the drainage design report written by Tetra Tech, Inc. (Tetra Tech, 2011). The Tetra Tech drainage design report (2011) is referenced in this Run-on and Run-off Control System Plan for the design calculation purposes only.

The run-on and run-off control system for the Ash Landfill is further described in Section 2.7 of this document.

2.2 Amendment of the Plan §257.81(c)(2)

As per §257.81(c)(2), the Run-On and Run-Off Control System Plan may be amended at any time provided the revised plan is placed in the facility's operating record by the timeframes as described in the following section of this document. The Run-On and Run-Off Control System Plan must be amended whenever there is a change in conditions that would substantially affect the written plan in effect.

2.3 Timeframes for preparing the Initial Plan §257.81(c)(3)(i)

TEP has met the timeframe for preparation of the Initial Run-On and Run-Off Control System Plan for an existing CCR unit by placing this Plan in the facility's operating record by October 17, 2016.

2.4 Frequency for Revising the Plan §257.81(c)(4)

As per §257.81(c)(4), TEP will revise the Run-On and Run-Off Control System Plan every five years from the date of the previous plan. The revised plan is considered complete when the plan is placed in the facility's operating record.

TEP has met the timeframe for preparation of the Updated Run-On and Run-Off Control System Plan for the existing CCR unit by placing this Updated Plan in the facility's operating record on October 14, 2021.

2.5 Certification of the Plan §257.81(c)(5)

As per §257.81(c)(5), a certification of the Run-On and Run-Off Control System Plan for the Ash Landfill must be obtained from a qualified professional engineer stating that the Ash Landfill meets the requirements set forth in the CCR rules. Certification for this plan is presented on Page ii of this document.

2.6 Recordkeeping, Notification, and Internet §257.81(d)

As per §257.81(d), TEP will comply with the recordkeeping requirements specified in §257.105(g), notification requirements specified in §257.106(g), and internet requirements specified in §257.107(g).

TEP will place the initial and periodic Run-On and Run-Off Control System Plan in the facility's operating record. §257.105(g)(3). The initial Plan will be replaced by amended and/or periodic plans as they are required.

TEP will provide notification of the availability of the initial and periodic Run-On and Run-Off Control System Plan to the relevant State Director and/or Tribal authority before the close of business on the day the notification is required to be completed. §257.106(g)(3).

TEP will place the initial and periodic Run-On and Run-Off Control System Plan on TEP's CCR Web site. §257.107(g)(3). The initial Plan will be replaced by amended and/or periodic plans as they are required.

2.7 Run-On and Run-off Control System for the Ash Landfill

TEP retained Tetra Tech to design run-on and run-off control system structures for the Ash Landfill and TEP oversaw the construction of Retention Structure No. 3. The original plan for the existing landfill, as outlined by Tetra Tech (2011), was a 20-year expansion; however, the schedule was accelerated and the landfill expansion construction was completed thru Phase 5 of Ash Capacity (upstream of Retention Structure No. 3) as shown by Tetra Tech (2011). The landfill expansion started receiving ash prior to Oct 14, 2015.

Stormwater run-on and run-off calculations and the evaluation for the Ash Landfill through Phase 5 and Retention Structure No. 3 were performed by Tetra Tech (2011) using the 100-year, 24-hour storm event; which is more conservative than required by CCR Rules. Tetra Tech (2011) used the peak flow rate, based on the 100-year, 24-hour storm event to determine the discharge calculations for drainage structures (i.e. drainage berms, ditches and retention structure). An excerpt from Tetra Tech (2011) is included in **Appendix A**. AMTECH developed a drawing identifying the existing run-on and run-off control system features based on topographical information provided by Tetra Tech (2011) and a 2021 survey performed by Perkins Cinders. This drawing is included in **Appendix B**.

2.7.1 Run-On Control System

According to Tetra Tech's drainage report, the run-on calculations were performed using the HEC-HMS software developed by U.S. Army Corps of Engineers (USCOE) to calculate drainage flow for a 100-year, 24-hour storm event. Rainfall for the site during a 100-year, 24-hour is 2.89 inches according to the "Precipitation-Frequency Atlas of the United States" NOAA Atlas Volume 1, Version 5.

There is a steep slope bounding the Ash Landfill to the north and gradual slope to the south. In order to handle the run-on, Tetra Tech designed drainage channels and berms along the toe of the north and south slopes to direct stormwater falling outside the limits of the Ash Landfill away from the site. Run-on volumes flowing into these channels on the northwestern and southern areas are designed to flow to the west and away from the active fill areas. Stormwater discharging to the northeastern portion of the northern channel is directed to a natural sink located at the northeastern corner of the Ash Landfill. Run-on retained in the sink either infiltrates or evaporates and the sink has a storage capacity of approximately 6.2 Acre Feet (ac-ft). Due to topography along the north of the active fill areas, stormwater sheet flows from north to south into a perimeter v-ditch constructed outside the northern perimeter boundary of the Ash Landfill. Topography south of the active fill area allows stormwater flow from south to north into a perimeter ditch/channel constructed outside the southern perimeter berm to prevent run-on into the active fill area of the Ash Landfill.

Based on Tetra Tech's as-built drawing, TEP constructed perimeter berms along the southern and northern boundaries of the Ash Landfill. As stated earlier, these perimeter berms were designed to prevent run-on into the Ash Landfill area from a 100-year, 24-hour storm event.

AMTECH's review of Tetra Tech's drainage calculations and the associated as-built drawing, which had no significant changes, confirms compliance with the CCR rules contained in §257.81, as the rule requires run-on control system for a 25-year, 24-hour storm event only.

2.7.2 Run-Off Control System

Tetra Tech performed the storage requirement evaluation for the run-off control dam and channels using the HEC-HMS software developed by U.S. Army Corps of Engineers (USCOE) to calculate drainage flow for a 100-year, 24-hour storm event. As stated earlier, rainfall for the site during a 100-year, 24-hour is 2.89 inches according to the "Precipitation-Frequency Atlas of the United States" NOAA Atlas Volume 1, Version 5A.

Tetra Tech (2011) designed the southern perimeter berm that provides run-off control and directs flow east to west along the toe of the southern landfill side-slope and eventually drains into the retention structure located on the western most side of the Ash Landfill area. The side-slopes of the completed Ash Landfill are constructed with slopes of 1.45 Horizontal: 1 Vertical (1.45:1) and benches every 5 to 10 vertical feet. Stormwater falling directly on the Ash Landfill is contained within the fill footprint. Stormwater falling on the lower side slopes of the fill sheet flow to perimeter drainage channels located to the north and south which direct the stormwater run-off to the existing dam for evaporation and infiltration. According to Tetra Tech (2011), the watershed area for Retention Structure No. 3 (encompassing Phase 5 of Ash Capacity) is approximately 0.6 square miles and the average slope of the area is 3.79 percent sloping westerly. Stormwater falling directly on the active fill areas are contained on the fill with the exception of the lower side slopes. The western area of the existing fill sheet flows and expected peak discharge of 532 cubic feet per second (cfs). Tetra Tech (2011) confirms that the minimum storage capacity needed for the area is approximately 45.7 ac-ft. The Retention Structure No. 3 embankment is designed to be approximately 6-feet in overall height and measures 1,150 ft. in length and constructed using fly ash and sandy clay to provide a retention storage capacity of 48 ac-ft. In addition, the design of the emergency spillway measuring 2 ft. deep by 110 ft. long on the top section of the embankment would handle the 100-year, 24-hour storm event in order to control over topping. The spillway maintains a minimum 2-foot freeboard during the 100-year, 24-hour storm event. The spillway is capable of discharging stormwater at 798.0 cfs.

The northern perimeter berm directs run-off from the northern landfill side-slope and eventually drains into the retention structure located on the western most side of the Ash Landfill area. Also the run-off from the active area of the Ash Landfill sheet flows into the same retention structure located on the western most side of the Ash Landfill area.

Based on Tetra Tech's (2011) as-built drawings and drainage calculations, the Retention Structure No. 3 was designed and constructed to handle the run-off from the active portion of the Ash Landfill area. Stormwater sheet flowing from the east is collected in the retention structure. Stormwater in the retention structure either infiltrates or evaporates. The retention structure embankment was designed and constructed to prevent overflow of the run-off from the retention structure. As the CCR rule requires run-off control for a 25-year, 24-hour event only, the existing run-off control system, pursuant to §257.81(b), satisfies the requirement of the CCR rule. Furthermore, the containment capacity of the drainage at the retention structure prevents over flow of the run-off from the active portion of the Ash Landfill in compliance with the surface water requirements stipulated in §257.3-3.

For this updated plan, AMTECH performed drainage calculations for the 25-year, 24-hour storm event to calculate the stormwater volume for the drainage area, which did not change significantly. Based on this calculation, the volume expected from the 25-year, 24-hour storm event required by the CCR rule is approximately 33.9 ac-ft which is less than the designed 45.7 ac-ft of required capacity in Retention Structure No. 3, thus confirming compliance.

3 REFERENCES

1. Tetra Tech, 2011. *Design Report, Ash Disposal Facility Expansion, Springerville Generating Station, Tucson Electric Power Company,* by Tetra Tech, dated November 2011.

APPENDIX A

EXCERPT FROM TETRA TECH DRAINAGE DESIGN REPORT (2011)

DESIGN REPORT
ASH DISPOSAL FACILITY EXPANSION
SPRINGERVILLE GENERATING STATION
TUCSON ELECTRIC POWER COMPANY

Prepared for:

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Tetra Tech Job. No. 133-25798-11001

November 2011

TETRA TECH

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1.0 INTRODUCTION

1.1 <u>Objective and Project Description</u>

The Springerville Generating Station (SGS), a coal-fired, steam electric generating facility, has identified the need to expand the existing ash disposal facility. Tetra Tech has evaluated the site, and developed a design for a 20-year expansion, and the requirements for a 40-year master plan. The 20-year expansion will be completed in three phases. Prior to ash disposal, Retention Structure No. 3 will be constructed. Overburden will be stripped from the footprint of each phase prior to ash disposal. Approximately 7 to 29 million cubic yards of ash and construction debris will be disposed of in each phase.

1.2 <u>Scope of Work</u>

This report includes information on the existing site conditions, site hydrology and hydraulics, and design concepts. Additionally, calculations and photo logs have also been included in Appendix A. Geotechnical information is presented in Appendix B.

This report focuses on the design for the 20-year expansion, including the design of Retention Structure No. 3, the Northeast “sink,” and the decommissioning of the Retention Structure No. 2. General requirements for the 40-year expansion are also presented within the report.

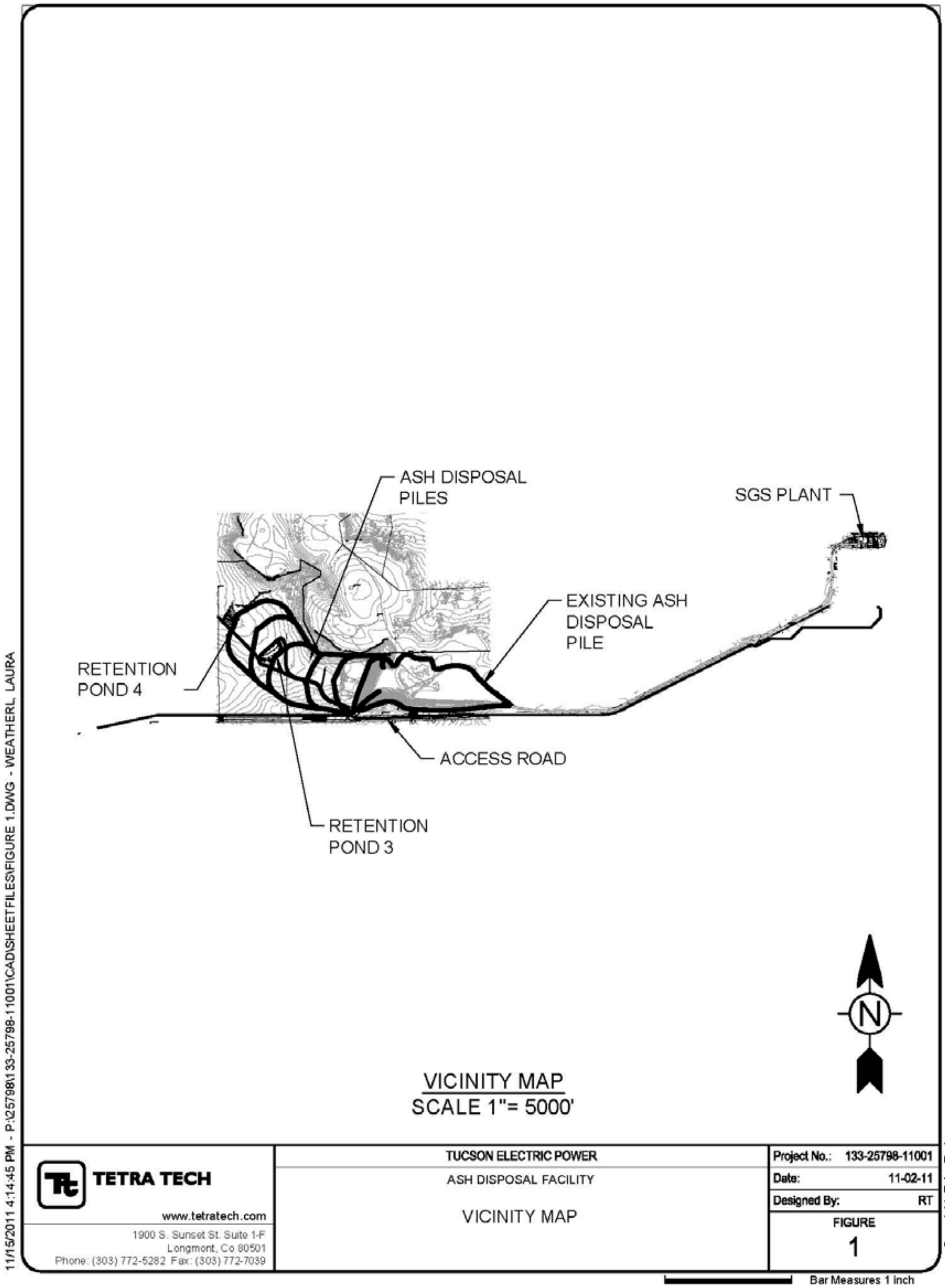
1.3 <u>Design Criteria</u>

Arizona Statutes Section 45-1201 defines a *dam* as any artificial barrier, including appurtenant works for the impounding or diversion of water, twenty-five feet or more in height or the storage capacity of which will be more than fifty acre-feet, but does not include any barrier that is or will be less than six feet in height, regardless of storage capacity.

Dam height is defined as the vertical distance from the lowest elevation of the outside limit of the barrier at its intersection with the natural ground surface to the spillway crest elevation.

The heights of the proposed embankments (Retention Structures No. 3 and No. 4), is less than six feet, and are therefore, not considered jurisdictional dams. The proposed embankments will be designed to retain a discharge of the 100-year 24-hour return flood. The auxiliary spillway in Retention Structure No. 3 is designed to convey 1.5 times the 100-year flood discharge.

Figure 1. Location Map



2.0 SITE HYDROLOGY AND HYDRAULIC ANALYSES

2.1 Existing Topography and Features

The ground surface slopes down moderately to the west. The site is bounded on the north by a mesa cresting at an elevation of 6960. The site is bounded on the east by a shallow ridge line at an elevation of 6950.

The existing ash disposal facility borders the site to the east. A small ephemeral stream channel runs through the site from east to west. The channel is incised 2 to 4 feet into the surrounding grade. Vegetation consists of scattered grasses and scrub trees.

2.2 Hydrologic Calculations

2.2.1 Watershed Delineation

Watershed delineation was performed using the USGS topographic map. Watershed delineations were performed for Retention Structure No. 3, the Northeast sink, and Retention Structure No. 4. The Northeast sink collects water from the northeastern part of the project area. Retention Structure No. 3 collects water from the drainage area east of Structure and from drainage areas that originally collected into Retention Structure No 2. Retention Structure No. 4 is a future retention structure, and will collect water from drainage area east of the structure. The watershed delineation maps are shown in Figure 2 and summarized on Table 1.

2.2.2 Watershed Characteristics

Watershed characteristics, such as length of the longest watercourse, slope, and centroidal length were calculated using ArcGIS software. The watershed characteristics are shown in Table 1. The areas of the watershed are less than 0.6 square miles and the slopes of the basins range from 200-250 feet/mile.

Table 1. Watershed Characteristics

	Watershed Area	Percent Impervious Area	Length of the Longest Watercourse	Slope	Centroidal length	Time of Concentration	Storage Coefficient	Storage
Units	**sq mi**	**%**	**mi**	**ft/mile**	**mi**	**hr**	**hr**	**ac-ft**
Symbol	A		L	S	L_{ca}	Tc	R	
Retention Structure 3	0.60	26.8%	1.27	200	0.46	0.69	0.40	45.7
Retention Structure 4	0.49	37.0%	1.09	257	0.67	0.68	0.39	42.7
Sink	0.13	0.0%	0.52	235	0.14	0.34	0.21	6.2

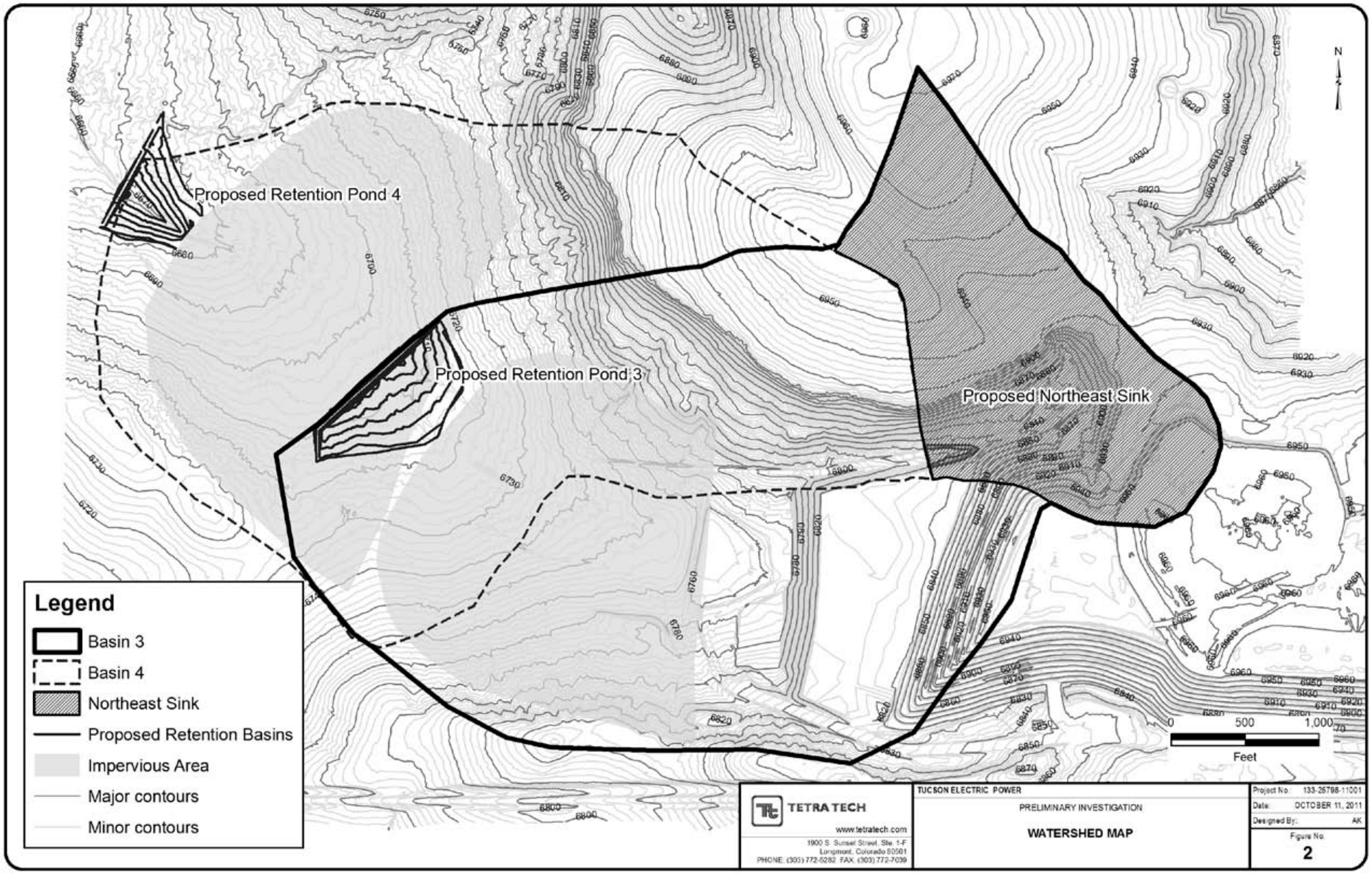


Figure 2. Watershed Map

2.2.3 Precipitation

Rainfall data for Springerville, Arizona was obtained from the "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 5. The point precipitation depths based on meteorological station near Springerville Municipal Airport and the values are shown in Appendix A. The point rainfall depth for 100-year, 24-hour rainfall is 2.89 inches.

For modeling purpose, a frequency based hypothetical storm, which is programmed into the HEC-HMS software, was used as the design storm.

2.2.4 Soil and Infiltration Losses

"Soils data for the project site was obtained from http://soildatamart.nrcs.usda.gov/. It was found that the soils in the watershed are gravelly loam to sandy loam.

The vegetation cover type in the project area varies from desert to rangeland type. Initial abstraction of 0.1 inches was used for desert and rangeland cover type. Infiltration losses were calculated using Green-Ampt's method as suggested in the *Highway Drainage Design Manual – Hydrology"* document prepared by the Arizona Department of Transportation (ADOT).

The area of each soil type in the watershed was calculated using ArcGIS software. The hydraulic conductivities for soil types are available from the soil survey report. The lower end values in published range of hydraulic conductivities were selected to calculate infiltration losses. Soil coverage in the watershed and the physical properties of soils are shown in Table 2.

Table 2. Soil Coverage and Physical Properties

Soil Type		Area (acres)	Hydraulic Conductivity (in/hr)	Suction Head (inches)	Initial Abstraction (in)
HUC2	Hubert gravelly loam, 2-15 % slopes, eroded	45.7	0.85	3.6	0.25
WFB	Winona fine sandy loam, 0-8% slope	217.7	0.85	3.6	0.25
HUB	Hubert gravelly loam, 0-8 % slope	345.0	0.85	3.6	0.25
Total		608.4	0.85	3.6	0.25

2.2.5 Impervious Flow Areas

The ash was assumed to solidify and provide no infiltration. Thus, the ash piles are considered as impervious flow area. The project will be constructed in two phases. The retention Structure No. 3 and the northeast sink will be constructed simultaneously and fly ash will be places upstream of these structures. In 20 to 25 years the fly ash in Phases 3, 4, and 5 upstream of Retention Structure No 3 will be at capacity. After the ash in each phase is placed, it will be covered with a one-foot thick layer of top soil.

Retention Structure No. 4 will be constructed after Retention Structure No. 3 approaches its capacity. When analyzing Retention Structure 4, the area that was considered as impervious flow for Retention Structure No. 3 is now considered as zero. Ash will be placed upstream of Retention Structure No. 4 and in Phases 6 and 7. The impervious areas are shown in Figure 1.

2.2.6 Unit Hydrograph and Time of Concentration

Clark's unit hydrograph method was used for rain-runoff transformation. Time of concentration was calculated using Equation 1, and the storage coefficient was calculated using Equation 2 below. The calculated values for time of concentration and storage coefficient are shown in Table 1.

$$T_C = 2.4\, A^{0.1} L^{0.25} {L_{ca}}^{0.25} S^{-0.2} \qquad \text{Equation 1}$$

$$R = 0.37\, {T_c}^{1.11} L^{0.8} A^{-0.57} \qquad \text{Equation 2}$$

Where
Tc = time of concentration in hours
A = area in square miles
L = length of the watercourse to the hydraulically most distant point
L_{ca} = length measured from the concentration point along L to the point on L that is perpendicular to the watershed centroid in miles
S = watershed slope in ft/mile
R = time in hours

2.2.7 Results

The HEC-HMS program was used for numerical simulation of the 100-year storm. The sandy loam and gravelly loam soils allow for high infiltration, and a substantial portion of the precipitation is infiltrated. The remainder of the precipitation runs off. The total volume of water and peak discharges in the proposed retention basins are shown in Table 3 below. The total volume of water in Retention Structure No. 3 is 45.7 acre-feet and Northeast sink is 6.2 acre-feet.

Table 3. Basin Peak Discharge Runoff Summary

Facility	Storage Ac-ft	Peak Discharge cfs
Retention Structure No. 3	45.7	532
Retention Structure No. 4	42.7	476
Northeast Sink	6.2	166

2.3 Emergency Spillway

An emergency spillway is necessary for the structure to pass a storm event that is greater than the design event. The spillway for Retention Structure No. 3 was set at an elevation of 6711.0 feet, which provides storage is of 48 acre-feet, which is greater than the 100-year discharge volume of 45.7 acre-feet. The spillway is designed to convey 798 cfs. The spillway crest is a broad crested weir with width of 110 feet. Assuming a weir coefficient of 2.6, the water depth at the auxiliary spillway is 2 feet.

3.0 DESIGN CONCEPT

3.1 General

The facility is planned to be constructed in 5 phases over the next 40 years. Phases 3, 4, and 5 will each contain about 7 to 18 million CY of material and will be constructed over the next 20 years. Phases 6 and 7 will each contain about 24 to 29 million CY each and will be constructed from 20 years to 40 years. The facility will be a zero discharge of surface water. This will be accomplished by collecting runoff form the operation phases in retention structures and containing runoff within completed phases by negative surface drainage.

Table 4 Summary of Ash Disposal Capacity

Phase	Ash Capacity cy
3	7.6 million
4	18.0 million
5	22.1 million
6	24.7 million
7	29.0 million
Total	**101.4 million**

Each phase will be constructed using 3.6:1 (horizontal to vertical) slopes and 5 foot high benches. Fly ash will be the only material placed from the face of the slope to 75 feet beyond the face of the slope. Remaining materials including fly ash, bottom ash, sediment, and construction debris will be placed beyond the 75 foot limit. Prior to placement of ash subgrade preparation will be required. The preparation will consist of removal of a minimum of 5 feet of soil from the disposal area. An additional 5 feet of material will be removed from the first 250 feet from the toe of each phase. The soil removed will be stockpiled for use as final 2 foot thick cover.

3.2 Retention Structure No. 3

For the 20-year plan, a 6-foot high, 1,150 feet long embankment comprised of fly ash and sandy clay fill has been designed to retain 48 ac-ft of water. The structure will be a zero discharge facility, as all collected water in the reservoir will be released through evaporation and infiltration. The embankment material will be composed of onsite borrow material and onsite fly ash. A key trench shall be excavated along the alignment of the embankment. The key trench should be excavated a minimum of 2 feet into the claystone bedrock and have a minimum 10-foot wide bottom with 1:1 (H:V) side slopes extending to the existing grade. The embankment fly ash core provides an impermeable barrier for water containment. Detailed geotechnical design criteria is presented in Appendix B.

An overtopping 110-foot wide emergency spillway was included in the design of the retention structure. The spillway is designed to operate for the 100-yr storm event. At high water line stage, the retention structure will have 2 feet of freeboard. A summary of the proposed embankment features is shown below in Table 4

In order to collect offsite surface drainage from the north of the site once Retention Structure No. 3 is filled in, a trapezoidal channel, lined with fly ash, will be used for interceptor conveyance. The channel will convey surface runoff to either the Retention Structure No. 4 or the Northeast sink. The channel will have 2:1 side slopes and a 3 ft bottom width, and will have a depth of 2.2 ft – 3.2 ft.

Table 5: Summary of Retention Structure Features
Retention Structure No. 3

Retention Structure	
Type:	Fly Ash and Earth Embankment Structure
Crest Elevation:	6713 ft
Crest Width:	12 ft
Crest Length:	1150 ft
Streambed Elevation at Structure Axis:	6707 ft
Lowest Foundation Elevation (Estimate):	6675 ft
Valley Floor Elevation at Downstream Toe:	6705 ft
Retention Structure Height (spillway crest to lowest point of original streambed):	6 ft
Structural Height (Structure crest to lowest point in foundation):	36 ft
Spillway	
Type:	Broad Crested Weir
Crest Elevation:	6711 ft
Width:	110 ft
Maximum Capacity at retention structure crest:	800 ft^3 / sec
Freeboard above Spillway Crest Elevation:	2 ft
Reservoir Storage:	45.7 ac-ft

3.3 Breach of Retention Structure No. 2

Retention Structure No. 2 is the facility's existing retention structure. As a result of the expansion, the retention structure will need to be breached and decommissioned. A trapezoidal channel breach having a bottom width of 4 feet and side slopes of 1.5H:1V has been designed to pass the 100-year flood through Retention Structure No. 2. The excavated material from the embankment breach can be placed upstream of the retention structure. The channel has a slope of 1% towards the west. Manning's roughness coefficient for the cut section through the embankment was assumed 0.02. The flow velocity through the embankment cut section is calculated to be 12.7 feet per second.

3.4 Northeast Sink

An embankment comprised of materials excavated from Retention Structure No. 3 has been designed to prevent standing water in the northeast sink to come in contact with the Phase 3 ash piles. The embankment will be keyed-in 2 feet below the existing ground elevation and its crest height is elevation 6849. A total capacity of 6.2 AC-FT of water will be available in this location.

Assuming complete flooding at this location (water surface elevation at 6849) 0.45 acres of the adjacent land owners property will be flooded.

3.5 Retention Structure No. 4

Retention Structure No. 4 will be required once Phases 3, 4, and 5 reach capacity. The design will utilize a fly ash embankment structure. The structure will have 42.7 ac-ft of storage.

3.6 Haul Roads

Delivery of ash to the disposal site will be accomplished using off road haul trucks. Typical delivery will be handled by 5 trucks making 15 to 20 trips per day. Each truck will deliver about 20 CY of ash for disposal. The existing haul road from the plant to the facility consists of a chip seal overlying 12" of aggregate base course mixed with lime/ fly ash overlying 24" of compacted fly ash. This haul road will remain in place for the expansion.

Temporary haul roads to access each phase will handle a combination of one way and two way traffic. The road layout is shown in the drawings and is based on a maximum grade of 10%. One lane roads will be approximately 30 feet in width and two way roads will be on the order of 60 feet wide. The roads will be graded using 4 to 6" of bottom ash overlying 6 to 12" of compacted fly ash.

3.7 Monitoring Plan

Monitoring of the performance of the facility will be accomplished by periodic visual observation and measuring of conditions in monitoring wells.

Visual observation will be performed on a monthly basis to evaluate the following:

- Surface drainage along edge of operating phase
- Stability of the operation face of the phase
- Condition of driving surface of temporary haul roads
- Water level in the retention structure and any signs of seepage or instability

There are three existing monitoring wells in the project area. These wells provide a satisfactory long term monitoring grid for the project. The current quarterly monitoring program will be continued. Two additional monitoring wells will be added in the northwest portion of the site. One of the wells will be screened from a depth of 80 feet to the bottom of the well at 160 feet. The second monitoring well will be screened from a depth of 20 feet to the bottom of the well at 30 feet. These wells will be included in the quarterly monitoring program.

4.0 REFERENCES

Arizona Administrative Code (AAC), Title 18. Environmental Quality, Chapter 7. Department of Environmental Quality – Remedial Action. http://www.azsos.gov/public_services/Title_18/18-07.thm

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Appendix A

CALCULATIONS

CALCULATION COVER SHEET

Client: **Tucson Electric Power Company** Project No.: 133-25798-11001

Project Name: **Ash Disposal Facility Expansion**

Title: Design Auxiliary Spillway for Retention Pond 3 and Decommission Retention Pond 2

Total Number of Pages (including cover sheet): 2

Total Number of Computer Runs: None

Prepared by: Amit Karki Date: 11/21/2011

Checked by: Jeffrey Butson Date: 11/21/2011

Description and Purpose:

The purpose of this calculation is to design auxiliary spillway for Retention Pond 3 and decommission the existing Retention Pond 2.

Design Basis/References/Assumptions:

Sizing Auxiliary Spillway for Retention Pond 3

Based on Figure 5.6 of Hydrometeorological Report (HMR) No. 49, the 24-hour Probable Maximum Precipitation (PMP) is about 1.5 times the 100-year 24-hour precipitation. Therefore, the auxiliary spillway for Retention Pond 3 is designed to convey 1.5 times the 100-year 24-hour peak discharge. The 100-year peak discharge equals to 532 cfs and the auxiliary spillway is designed to convey a discharge of 798 cfs. The auxiliary spillway is designed as a broad-crested spillway, and the discharge over the broad-crested spillway is calculated using the following equation.

$$Q = CLH^{1.5}$$

Where,
Q = discharge in cfs
C = weir coefficient
L = length of the weir in feet
H = depth of water in feet

The following parameters, as shown in Table 1 below, are used to calculate weir discharge.

Table 1. Design of Auxiliary Spillway

Design Parameter	units	
Design Discharge	cfs	798.0
Width of the spillway	ft	110.0
Headwater at the spillway	ft	2.0
Discharge coefficient	c	2.6
Side slopes		2H:1V
Elevation of the auxiliary spillway	ft	6711.0
Total depth of AS	ft	2.0
Additional freeboard	ft	0

Decommissioning of Retention Pond 2

The Existing Retention Pond 2 will be decommissioned by cutting a trapezoidal channel through the embankment. The cut section through the embankment is designed to convey a 100-year discharge of 532 cfs. For convenience, it was assumed that the 100-year discharge at Retention Pond 2 is equal to the 100-year year discharge at Retention Pond 3. Normal depth calculation using Manning's equation, as shown below, was used to calculate the size of the opening through the dam embankment.

$$Q = \frac{1.49 * A * R^{2/3} S^{1/2}}{n}$$

Where,
Q = discharge in cfs
A = cross-sectional area
R = hydraulic radius
S = slope of the channel
n = Manning's roughness coefficient

The parameters used to calculate the size of the channel opening are shown in Table 2 below.

Table 2. Design of Cut Section through Retention Pond 2

Peak 100-year discharge	cfs	532
Slope through the cut channel	%	1
Invert elevation at the upstream	ft	6756
Invert elevation at the downstream	ft	6754.5
Side slope of the cut section		1.5H:1V
Manning's roughness coefficient	n	0.02
Bottom width	ft	4
Velocity through the cut section	ft/s	12.7
Depth of flow	ft	4.12

Results:

The auxiliary spillway for Retention Pond No. 3 is designed as a 110-feet long broad-crested weir with side slopes of 2H:1V. The Retention Pond 2 is decommissioned by cutting a trapezoidal section through the embankment. The bottom width of the designed section is 4 feet and the side slopes are 1.5H:1V.

Calculation Approved by: ______________________ 11/21/11

Project Manager — Date

Revision No.: — Description of Revision: — Approved by:

Project Manager/Date

CALCULATION COVER SHEET

Client: **Tucson Electric Power Company** Project No.: 133-25798-11001

Project Name: **Ash Disposal Facility Expansion**

Title: Hydrologic Calculations for Retention Pond 3 and 4, and the Northeast Sink

Total Number of Pages (including cover sheet): 3

Total Number of Computer Runs: 1

Prepared by: Amit Karki Date: 11/21/2011

Checked by: Jeffrey Butson Date: 11/21/2011

Description and Purpose:

The purpose of this task is to perform hydrologic calculations to determine the 100-year peak discharges and runoff volumes for Retention Ponds No. 3 and 4, and the Northeast Sink.

Design Basis/References/Assumptions:

The hydrologic calculations were performed based on "*Highway Drainage Design Manual – Hydrology*" document prepared by the Arizona Department of Transportation (March 1993).

Calculations

Rainfall data for Springerville, Arizona was obtained from the "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 5. The point precipitation depths are based on meteorological station near Springerville Municipal Airport and the precipitation values are shown in Table below.

Watershed delineation, watershed characteristics, soil and infiltration losses, impervious areas, unit hydrograph, and time of concentration are discussed in detail in Section 2.0 of the report. The precipitation and basin input files, and the screen shot from the HEC-HMS output are included at the end of this appendix.

Table. Point precipitation frequency estimates (inches)

NOAA Atlas 14, Volume 1, Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 34.1333
Longitude (decimal degrees): -109.3000

	Precipitation Frequency Estimates in Inches									
by duration for ARI:	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.21	0.26	0.35	0.41	0.49	0.56	0.64	0.71	0.81	0.89
10-min:	0.32	0.4	0.53	0.62	0.75	0.86	0.97	1.08	1.23	1.35
15-min:	0.39	0.5	0.65	0.77	0.94	1.06	1.2	1.34	1.53	1.68
30-min:	0.53	0.67	0.88	1.04	1.26	1.43	1.61	1.8	2.06	2.26
60-min:	0.65	0.83	1.09	1.28	1.56	1.77	2	2.23	2.55	2.8
2-hr:	0.72	0.92	1.19	1.41	1.73	1.98	2.25	2.54	2.93	3.25
3-hr:	0.76	0.96	1.23	1.46	1.78	2.04	2.31	2.61	3.03	3.38
6-hr:	0.87	1.09	1.38	1.62	1.97	2.26	2.56	2.89	3.36	3.75
12-hr:	0.98	1.23	1.54	1.79	2.15	2.43	2.73	3.05	3.51	3.89
24-hr:	1.15	1.42	1.74	2	2.35	2.62	2.89	3.17	3.54	3.93
2-day:	1.3	1.6	1.96	2.25	2.63	2.93	3.23	3.54	3.94	4.25
3-day:	1.43	1.76	2.15	2.47	2.89	3.22	3.55	3.88	4.33	4.67
4-day:	1.55	1.92	2.34	2.69	3.15	3.5	3.86	4.23	4.71	5.09
7-day:	1.89	2.33	2.83	3.23	3.77	4.19	4.6	5.02	5.58	6
10-day:	2.17	2.67	3.22	3.68	4.29	4.74	5.22	5.7	6.33	6.81
20-day:	3.02	3.73	4.48	5.07	5.85	6.43	7.01	7.57	8.3	8.83
30-day:	3.71	4.58	5.46	6.12	6.99	7.61	8.21	8.78	9.49	10.01
45-day:	4.75	5.85	6.93	7.74	8.73	9.43	10.1	10.7	11.43	11.93
60-day:	5.5	6.79	8.04	8.95	10.07	10.84	11.57	12.23	13	13.53

Date/time (GMT): Tue Jul 19 20:10:36 2011

ARI : Average Recurrence Interval

Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Results:

The HEC-HMS program is used for numerical simulation of the 100-year storm. The sandy loam and gravelly loam soils found around the project site allow for substantial infiltration, and the remainder of the precipitation runs off. Runoff volumes and peak discharges at the proposed retention ponds are shown in Table below.

Table. Summary of Basin Peak Discharge and Runoff Volume

Facility	Storage Ac-ft	Peak Discharge cfs
Retention Structure No. 3	45.7	532
Retention Structure No. 4	42.7	476
Northeast Sink	6.2	166

Calculation Approved by: ____________________ 11/21/11

Project Manager Date

Revision No.: Description of Revision: Approved by:

____________ ____________________ ____________________

____________ ____________________ ____________________

Project Manager/Date

Basin: Basins
Last Modified Date: 21 November 2011
Last Modified Time: 22:29:10
Version: 3.5
Filepath Separator: \
Unit System: English
Missing Flow To Zero: No
Enable Flow Ratio: No
Allow Blending: No
Compute Local Flow At Junctions: No

Enable Sediment Routing: No

Enable Quality Routing: No
End:

Subbasin: Det Basin 3
Canvas X: -3262.081784386617
Canvas Y: 2118.9591078066915
Area: 0.60

Canopy: None

Surface: None

LossRate: Green and Ampt
Percent Impervious Area: 26.82
Initial Content: 0.25
Saturated Content: 0.434
Wetting Front Suction: 3.5
Hydraulic Conductivity: 0.85

Transform: Clark
Time of Concentration: 0.69
Storage Coefficient: 0.4

Baseflow: None
End:

Subbasin: Deten 4
Canvas X: 1105.9479553903348
Canvas Y: 2156.133828996283
Area: 0.49

Canopy: None

Surface: None

LossRate: Green and Ampt
Percent Impervious Area: 37.04
Initial Content: 0.25
Saturated Content: 0.434
Wetting Front Suction: 3.5
Hydraulic Conductivity: 0.85

Transform: Clark
Time of Concentration: 0.68
Storage Coefficient: 0.39

Baseflow: None
End:

Subbasin: Sink
Canvas X: 864.3122676579933
Canvas Y: -427.50929368029756
Area: 0.13

Canopy: None

Surface: None

LossRate: Green and Ampt
Percent Impervious Area: 0.0
Initial Content: 0.25
Saturated Content: 0.434
Wetting Front Suction: 3.5
Hydraulic Conductivity: 0.85

Transform: Clark
Time of Concentration: 0.34
Storage Coefficient: 0.21

Baseflow: None
End:

Basin Schematic Properties:
Last View N: 5000.0
Last View S: -5000.0
Last View W: -5000.0
Last View E: 5000.0
Maximum View N: 5000.0
Maximum View S: -5000.0
Maximum View W: -5000.0
Maximum View E: 5000.0
Extent Method: Elements
Buffer: 0
Draw Icons: Yes
Draw Icon Labels: Yes
Draw Map Objects: No
Draw Gridlines: No
Draw Flow Direction: No
Fix Element Locations: No
Fix Hydrologic Order: No
End:

Meteorology: Met 1
Last Modified Date: 16 November 2011
Last Modified Time: 20:32:45
Version: 3.5
Unit System: English
Precipitation Method: Frequency Based Hypothetical
Short-Wave Radiation Method: None
Long-Wave Radiation Method: None
Snowmelt Method: None
Evapotranspiration Method: No Evapotranspiration
Use Basin Model: BAsins
End:

Precip Method Parameters: Frequency Based Hypothetical
Exceedence Frequency: 1.00000
Single Hypothetical Storm Size: Yes
Convert From Annual Series: No
Convert to Annual Series: Yes
Storm Size: 0.555
Total Duration: 1440
Time Interval: 5
Percent of Duration Before Peak Rainfall: 50
Depth: 0.65000
Depth: 1.2000
Depth: 2.0000
Depth: 2.2500
Depth: 2.3100
Depth: 2.5600
Depth: 2.7300
Depth: 2.8900
Depth: 0.0
Depth: 0.0
Depth: 0.0
Depth: 0.0
End:

Subbasin: Det Basin 3

Begin Snow: None
End:

Subbasin: Deten 4

Begin Snow: None
End:

Subbasin: Sink

Begin Snow: None
End:

Global Summary Results for Run "Run 1"

Project: Project 1 Simulation Run: Run 1

Start of Run: 01Jan2000, 00:00
End of Run: 03Jan2000, 00:00
Compute Time: 21Nov2011, 15:36:39

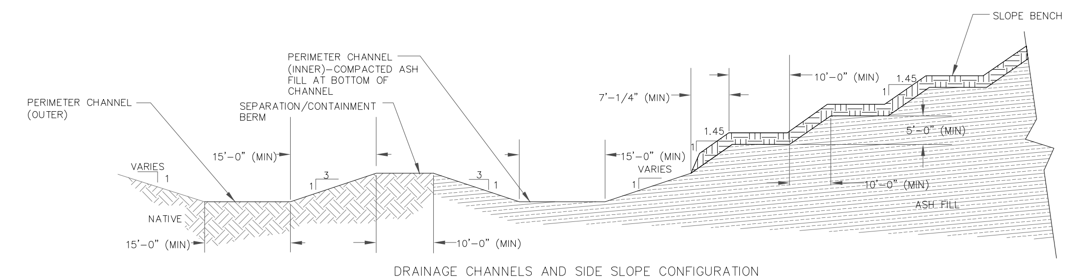
Basin Model: BAsins
Meteorologic Model: Met 1
Control Specifications: Control 1

Show Elements: All Elements Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Det Basin 3	0.60	531.9	01Jan2000, 12:35	45.7
Deten 4	0.49	475.9	01Jan2000, 12:35	42.7
Sink	0.13	166.1	01Jan2000, 12:20	6.2

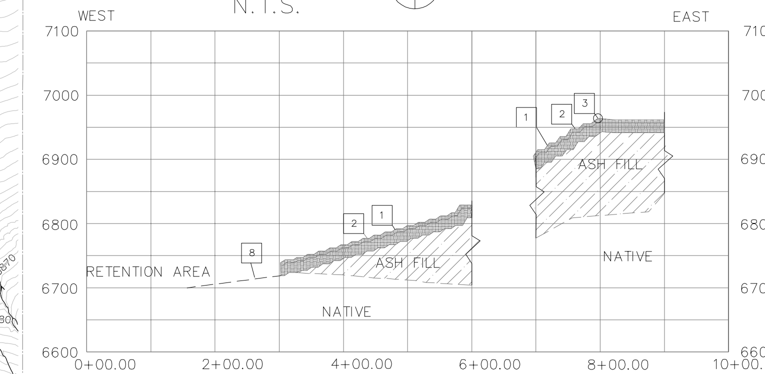
APPENDIX B

DRAWING 1
ASH DISPOSAL LANDFILL
RUN-ON / RUN-OFF CONTROL PLAN



DETAIL 1

N.T.S.

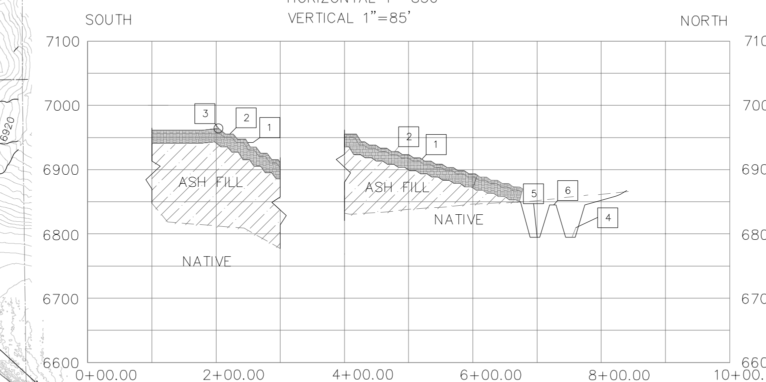


CROSS SECTION A-A

SCALE IN FEET

HORIZONTAL 1"=850'

VERTICAL 1"=85'



CROSS SECTION B-B

SCALE IN FEET

HORIZONTAL 1"=850'

VERTICAL 1"=85'

CALLOUT DEFINITIONS:

1. EXISTING INNER DRAINAGE CHANNEL
2. CLOSED ASH DISPOSAL AREA
3. EXISTING EARTHEN BERM
4. EXISTING RETENTION AREA
5. EXISTING OUTER DRAINAGE CHANNEL
6. EXISTING SEPARATION BERM
7. EXISTING ASH HAUL ROAD
8. EXISTING SPILLWAY
9. CLOSED ASH DISPOSAL AREA/NOT SUBJECT TO CCR'S
10. ACTIVE ASH DISPOSAL AREA/SUBJECT TO CCR'S
11. EXISTING NORTHEAST SINK
12. EXISTING PROPERTY LINE

CONST. NOTES:

1. THE OWNER SHALL CONST. ASH FILL SIDE SLOPES AT 1.45 HORIZONTAL TO 1 VERTICAL (1.45H:1V) BETWEEN BENCHES.
2. EVERY FIVE (5) FEET IN ELEVATION THE OWNER SHALL CONST. BENCHES ON THE ASH FILL. GRADE BENCHES WITH NO SLOPE IN EITHER DIRECTION AND CONST. TO A MINIMUM WIDTH OF TEN (10) FEET.
3. THE OWNER SHALL CONST. AND MAINTAIN AN EARTHEN BERM AROUND THE PERIMETER OF THE UPPER DECK SECTION OF THE ASH DISPOSAL AREA 2 FEET (FT) IN OVERALL HEIGHT TO CONTAIN THE STORMWATER FALLING DIRECTLY ON THE UPPER DECK AREA.
4. THE OWNER SHALL MAINTAIN CHANNEL FLOW LINES TO BE FREE OF DEBRIS AND TO MAINTAIN 2.0% GRADE.
5. THE OWNER SHALL CONST. INNER PERIMETER CHANNEL ADEQUATE TO CONVEY STORM WATER FROM A 25-YEAR/24-HOUR STORM EVENT PARALLEL WITH OUTER DRAINAGE CHANNEL AS SHOW ON THE DRAWING AS THE ASH FILL PROGRESSES WESTERLY. GRADE FLOW LINE AT A MINIMUM 2.0 PERCENT AND DAYLIGHT TO EXISTING RETENTION AREA.
6. THE OWNER SHALL MAINTAIN SEPARATION BERMS BETWEEN INNER AND OUTER CHANNELS.
7. NOT USED
8. THE OWNER SHALL REMOVE SEDIMENTATION WITHIN THE EXISTING RETENTION AREA AS NEEDED TO MAINTAIN ADEQUATE STORAGE CAPACITY DURING A 25-YEAR/24-HOUR STORM EVENT PER DRAINAGE DESIGN CALCULATIONS.
9. THE OWNER SHALL MAINTAIN AND OR REPAIR EARTHEN BERM AS NEEDED TO MAINTAIN THE STRUCTURAL INTEGRITY.

LEGEND:

6710	EXIST. CONTOUR ELEVATIONS
	EXIST. SECTION LINE
	EXIST. PROPERTY LINE
	EXIST. DRAINAGE AND PERIMETER CHANNEL FLOW LINE DERECTION
	EXIST. ROADWAY/HAUL ROADS
	EXIST. WATER SUPPLY PIPE LINE
xx xx	EXIST. FENCE LINE
	EXIST. CULVERT DRAINAGE PIPES
	EXIST. WATER FILL STATION
A–A A–A	CROSS SECTION

0 850 1700

SCALE FEET

AMTECH Associates, L.L.C.
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REV	ISSUE	DWG	DES	CHK	APP

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DES. BMK APPR. SSA

ISSUE DATE OCTOBER 2021

PROJECT NO. 1062.03

TUCSON ELECTRIC POWER COMPANY
SPRINGERVILLE GENERATING STATION
ASH DISPOSAL LANDFILL
PROJECT NO: 1062.03
RUN-ON / RUN-OFF CONTROL PLAN

DRAWING:

1 OF 1