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TOPOGRAPHIC AND GEOLOGIC SURVEY

George H. Ashley, State Geologist.

SAND AND GRAVEL IN THE READING REGION, PENNSYLVANIA.

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Introduction.

In 1937 the Pennsylvania Geological Survey started an investigation of the sand and gravel resources of the State by sending the writer on a reconnaissance trip over the whole State. Nearly all the large cities were visited. The purpose of this trip was to find: (a) where the sand and gravel supplies were coming from, whether they were local or whether they were being shipped in, (b) whether the supplies, from whatever source, were satisfactory as to quality, (c) total quantities needed, (d) costs, freight rates, etc. The problem was approached from the commercial end, which meant interviewing operators of pits and quarries, contractors, dealers, and chambers of commerce. All this was preliminary to detailed geological work which would be taken up in those regions least supplied, by nature, with these resources.

Reading was one of the regions visited. It was found that the local supplies were not adequate to meet all the needs, necessitating importation of sand from other regions. Since the larger part of the cost of sand and gravel is the item of transportation, it was clear that the Reading region was one that might be helped if more thorough investigation lead to the discovery of sand deposits nearer to the city.

In July of 1929 the writer made a detailed study of the Reading region. The immediate vicinity of the city and all the territory along the lines of transportation tributary to Reading for distances ranging from 25 to 35 miles were carefully examined. The accompanying map (Fig. 1) shows the railroad lines leading to Reading along which most of the work was done.

About five weeks was spent on the problem. All the work was done on foot which allowed close attention to detail. During the last week Forrest T. Hoyer served as assistant.

The problem involved finding deposits (a) of proper quality; (b) where there was opportunity for washing, because the trade, and especially the large contracts, is demanding a uniform, washed product; (c) large enough to warrant putting money into a washing plant and other equipment; (d) near railroad or other trunk line of transportation. Trucking will pay (if roads are good) when the distance is not over 10 miles, is doubtful between 10 and 15 miles, and unprofitable with greater distance. Of course, if the roads are good and one could get $4.00 or more a ton for delivery it would pay to haul by truck 25 or 30 miles. This is a rare case.

The results of this investigation are given in the following pages.
Fig. 1. Railroads in the Reading Region.

Uses.

Sand and gravel are low-priced commodities. This does not mean that they are an insignificant part of our industrial world. They are necessities and the volume used speaks of their importance. Of all the freight moved by the railroads of the United States in 1928, sand and gravel held fourth place in volume handled, being exceeded only by bituminous coal, anthracite, and iron ore. Every moderately large community uses on the average one ton per capita per year. Reading, then, with its outlying boroughs, needs, in round numbers, 125,030 tons of sand and gravel each year.

To make these materials better appreciated a brief list is given of the various uses to which they are put. These uses may be grouped in several ways, one of which is as follows:
Construction.

1. Concrete - for highways, streets, sidewalks, buildings, blocks, fence posts, etc.
2. Mortar - for laying brick, stone, etc.
3. Plaster and finishing coats.
4. Asphalt paving.
5. Roofing.
6. Cushion sand - for laying paving brick, etc.
7. Road dressing - travel alone; with binder for sand-clay roads; for oiled roads.
8. Railroad ballast.

Abrasives.

10. Sand blast.
12. Sawing stone.
14. Tumbling sand.

Manufacture (the main constituent).

15. Glass.
17. Silica brick.

Manufacture (as an accessory).

18. Foundry sand.
20. Pottery glaze.
22. Filler for fertilizer.
23. Sweeping compound.
24. Dusting paper.
25. Corborundum.

Miscellaneous.

27. Filters.
28. Engine sand.
29. Fire sand.
30. Standard sand.
31. Playground sand.
32. For golf courses.
33. On paint.
34. Bedding stock cars.
35. Sand flotation.
36. Horticultural purposes.
37. Agricultural testing.
38. Bird sand.

In a large community all of these uses will find a place, though naturally, as far as quantity is concerned, some are insignificant while others run into very large figures.

Specifications.

Quite logically, one kind of sand will not do for all purposes. A sand that is too fine for concrete may be just the thing for asphalt pavement; a sand that would never do for glass making may be entirely suitable for foundry purposes. The specifications or qualities required for each of the uses listed have been rather exactly determined, though authorities differ as to details. The extensive literature on the subject should be consulted by those who expect to be producers of these commodities. No attempt will be made here to discuss these specifications, but a partial list of the necessary qualities may make clearer the scope of the requirements.
In general, sand and gravel should be clean, that is, free from loam and organic matter. The individual particles should be durable. Texture plays an important part; this refers to the sizes of the individual particles and the proportions of the various sizes present. Their features are determined by standardized methods of screening. The shape of the particles is to be considered, too many flat pieces is objectionable. Chemical composition is important only for a few of the uses, especially the high silica sands. Strength tests are made for comparison with standard sands. Other properties that may enter into the qualities of good material are color, fusibility, permeability, sharpness of particles.

Those who wish to improve or standardize their product would do well to study the precise requirements that the best trade demands. Many articles are published by the National Sand and Gravel Association, Mule Bay Building, Washington, D. C., by the American Society for Testing Materials, Philadelphia, Pa., and by similar organizations. Specially, those who are interested in the specifications for highway work should consult Form 408, Pennsylvania Department of Highways, Harrisburg; or if planning to produce molding sands consult Molding Sands of Pennsylvania issued as Bulletin M 11 by the State Geological Survey, Harrisburg. Similarly each of the uses listed has its own literature.

Definitions.

This report makes use of certain terms whose meaning will be better understood by referring to the following definitions.

Bank Sand or Gravel. This term applies to ordinary sand and gravel such as is seen along a river bank. It has been carried there, sorted and deposited by water. It is loosely packed and hence easy to shovel or dig into. Coarse and fine material are arranged in alternating layers. Individual pieces commonly show the wear and tear they have suffered during transportation, that is, they have lost their angularity; some may even be well rounded. Often called river sands.

Quarry Sand. This is made artificially by crushing rock. The bedrock is quarried in the usual manner by the help of more or less blasting. The blocks of rock are further reduced by crushers or rolls, and then sorted into sizes by screens. The ordinary crushed rock is equivalent to the various gravel sizes; the finer sizes are the sand.

Texture. This term refers to the sizes of individual particles and also the proportion of the various sizes present.

| Sand - grains less than \( \frac{1}{2} \) inch: may be coarse, medium, fine. |
| Fine gravel - \( \frac{1}{4} \) to \( \frac{1}{2} \) inch. |
| Gravel - \( \frac{1}{2} \) to 1\( \frac{1}{8} \) inch. |
| Coarse gravel - 1\( \frac{1}{8} \) to 6 inches. |
| Boulders - greater than 12 inches. |
Except in the case of sand, the natural deposits seldom contain one size only, as above defined. Rather, there is a mixture of several sizes. For field purposes the writer has somewhat arbitrarily used four classes.

**Very coarse =** Probably 50 per cent greater than 3 inches. Much coarse gravel. Considerable number of cobbles. Boulders always present. Sand content low.

**Coarse =** Probably 35 per cent greater than 3 inches. Much coarse gravel. Cobbles fairly common. Boulders seldom present. Sand moderate.

**Ordinary =** Less than 20 per cent but more than 5 per cent over 3 inches. Moderate coarse gravel. Cobbles seldom present. Sand and fine gravel the dominant sizes.

**Fine =** Less than 5 per cent over 3 inches. Abundant sand.

This classification may be used in describing a single large bed, or, more often, for the average of the whole deposit.

**Quantity.** Since quantity is one of the requirements of the sand and gravel problem, the descriptive terms used must be given some exactness. They are based on the requirements for commercial plants. It will seldom be possible to get proper returns on capital invested in a washing plant and other equipment unless the operation is continued for at least 10 years. On this basis the following terminology is used.

<table>
<thead>
<tr>
<th>Output per day</th>
<th>Reserves required</th>
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<tbody>
<tr>
<td>Very large</td>
<td>1,000 tons</td>
</tr>
<tr>
<td>Large</td>
<td>500 &quot;</td>
</tr>
<tr>
<td>Medium</td>
<td>200 &quot;</td>
</tr>
<tr>
<td>Small</td>
<td>100 &quot;</td>
</tr>
</tbody>
</table>

Experience shows that it is hardly practicable to set up a washing plant unless the output averages 10 tons per day.

**Value.** Waste material or unsalable product of a quarry or pit needs as much consideration as the quantity in the deposit. In a region where hard rock quarries and crushed rock are common there will be little use for a bank deposit in which gravel and coarse gravel dominate. Whatever its quality, coarse gravel will be hard to sell and constitutes an element of waste. The opposite is true; in a region where hard rock quarries are scarce and the bank deposit is largely sand, a great deal of the sand will have to be sold at a low price in order to get rid of it at all. In such a region a bank deposit with gravel and coarse gravel as well as sand would be the most profitable. In the Reading region, for instance, a straight sand deposit would be much more valuable than a coarse gravel-sand deposit. Again, much of the deposit may be fine sand, too fine for concrete. If the customers are only concrete makers, the excess fine sand is a waste product, in the way and unprofitable.
It amounts to this, the value of a bank deposit even when both quantity and quality are excellent, depends on the market demand within the range of profitable transportation.

Producers who are willing to study the many varieties of sand, know the many possible uses and specifications of each, may turn their waste product into a saleable article and so increase the value of their deposit as a whole. For instance, (a) an excess of coarse gravel may, when crushed and washed, be more acceptable in specification work than ordinary crushed rock; (b) the overburden may be just right for foundry sand; (c) excessive fine sand, while not saleable for concrete work, may be used in finishing work, asphalt paving, striking sand, etc.; (d) the fine powder washed from high silica quarry sand might have a use in securing compounds, etc.

Present Sources.

All of Reading's local sand is quarry sand. Usually a quartzite or other highly siliceous rock such as quartz schist, and less commonly granite is crushed for this purpose. In three of the quarries the rock is a coarse-textured trap, and in another quarry is a conglomerate. All of the rock is loosened by weathering to a depth of 10 to 25 feet. The quarries are located at various points, some near and some rather distant from the city. All are in the hills or uplands, never in the lowland areas. The following is a list of quarry sand producers near Reading and the neighboring towns.

<table>
<thead>
<tr>
<th>Quarry or Company</th>
<th>Location</th>
<th>Miles from Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temple Silica Sand Co.</td>
<td>about 1/2 mi. N.E. of Temple</td>
<td>6</td>
</tr>
<tr>
<td>Angstadt Quarry</td>
<td>1/2 mi. N.E. of Stony Creek</td>
<td>4 1/2</td>
</tr>
<tr>
<td>Highland Sand Co.</td>
<td>Neversink Mountain</td>
<td>1</td>
</tr>
<tr>
<td>Saidel Sand Co.</td>
<td>about 3/4 mi. S.E. of Salem Church</td>
<td>6</td>
</tr>
<tr>
<td>Springs Sand and Stone Co.</td>
<td>1 mi. S. of Sinking Spring</td>
<td>7</td>
</tr>
<tr>
<td>John H. Gring Quarry</td>
<td>S. of Sinking Spring</td>
<td>7</td>
</tr>
<tr>
<td>Petru Beyer Quarry</td>
<td>S. of Fleetwood</td>
<td>12</td>
</tr>
<tr>
<td>John T. Dyar Quarry Co.,(a)</td>
<td>S. of Gicksville</td>
<td>9</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot; &quot; &quot; &quot; &quot; &quot; &quot; (b)</td>
<td>at Trap Rock</td>
<td>11</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot; &quot; &quot; &quot; &quot; &quot; &quot; (c)</td>
<td>S.W. of Monocacy</td>
<td>14</td>
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</tbody>
</table>

Many other quarries have been opened but are now abandoned. New quarries could be opened at many other places.

The sand is prepared by crushing and screening the rock. Only at the Dyar quarry is the product washed. The screening produces sand of three sizes - concrete, mason, finishing. The gravel sizes (sometimes referred to as "spalls") are of the sort suitable for coarse aggregate, railroad ballast, etc. Chemically, most of the sands are of the high silica type, selected portions being suitable for glass sand. Much of the run-of-quarry product will show 95% silica, except of course that made from trap rock.

The daily output varies with the size of the plant and the demand. The plant capacities range from 25 to 300 tons per day. The sand sells for $2.00 to $3.00 per ton delivered in Reading, and $1.00 to $1.60 per ton at the quarry. In carload lots it may be bought at one quarry for $0.50 per ton.
Four of the quarries are located along the railroad or on spurs connecting with the railroad. The others deliver by truck. The many good roads facilitate hauling by truck, especially for the shorter distances.

Crushed and screened furnace slag is used in making concrete blocks or as coarse aggregate, little being consumed in any other way.

Distant Sources. A great deal of "Jersey" sand is used in the city. This is a bank sand, washed, and of standard quality, coming from several points in the Trenton district, including Morrisville and Tullytown, Pa. This means a railroad journey of 75 - 90 miles. With transportation such a big item in the ultimate cost of sand, this is an important part of Reading's sand bill. Jersey sand at the point of production costs about 70 cents per ton, while the freight is over $1.00 per ton. Jersey sand is delivered in Reading at an average cost of $2.20 per ton, while the quarry sands average $2.00 per ton.

Quarry vs. Bank Sand. In spite of the fact that Jersey sand costs over a dollar a ton more than the quarry sand, a great deal of it is used. Estimates place the total Jersey sand used as one-third to two-fifths of all the sand used by the city. The question naturally arises why do people pay more to import sand when they have sand at home? Considering all the uses of sand in the region, $40,000 - $50,000 per year could be saved if only the local sand were used.

Of one thing we can be sure, there is no shortage of rock from which the local quarry sand is made. There are enormous reserves of this material, enough to furnish several times the total needed for many years to come.

In the first place one must realize that no one sand can serve all purposes. The list of 36 uses on a previous page should convince one that several varieties and types of sand are required.

But if we confine our attention to the commoner uses, such as construction, there are some other reasons for the choice between the two types. Jersey sand by long usage in the east has become a standard product accepted as having the proper quality. The quarry sand, on the other hand, does not yet have a completely accepted position in the sand market. The burden of proof, thus, is with the quarry sand. The writer in talking with many dealers, contractors, masons, and some engineers, finds staunch supporters of each type of sand. No doubt there is some prejudice in the matter, and no doubt part of it is a matter of opinion, like buying any other article of trade.

Not many analyses are available. Tests on sand from five of the quarries show a strength equal to or greater than the standard Ottawa sand, in one case nearly twice the standard. It is true, too, that the quarry sand has been used successfully in many large structures in the region, as bridges, roads, factories, etc.

Despite this, two facts remain against the quarry sand as a whole. One is that the quarry sand is not uniform; the other is that there is apt to be too much "fines" in this sand. The rock is not all alike through the hills; its character may differ in one quarry. Sometimes too little care is taken in removing the overburden.
The problem of the quarry sand industry, then, is greater care in the selection of the rock and in handling the overburden, installation of additional screens to get rid of the fines, in some cases installation of washing systems, running of many tests and analyses to get exact information on what is being produced, and finally a good selling and advertising plan to place the improved, uniform product on a par with the standard Jersey sand.

No doubt there will always be a demand for Jersey sand for certain uses.

Detailed Studies.

Until the quarry sand is standardized, as suggested in the preceding paragraphs, the demand for a good bank sand equal to the standard Jersey sand will remain large; and afterwards there will always continue to be some need for the bank sand. There is the further possibility that the quarry sand producers will be satisfied with conditions as they are.

Hence the greater part of the field work in this region was devoted to the search for bank sand. A large deposit of good bank sand within 25 miles of the city would save the long haul and high freight costs of the New Jersey product. Because of the importance of transportation in the sand problem, the search for bank sand was confined to areas along and near the railroad lines. The need for a sand of proper quality and in quantity sufficient to justify exploitation was always kept in mind.

Barren Areas. There is always an advantage in knowing one's limitations. Uncertainty is disturbing. To prove the lack or absence of a certain material is one of the factors in any industry. To state the worst first, then, certain areas in the region, we are sure, contain no commercial bank sand and gravel.

Bank sand being a water-laid material, it is natural to look for it in present or former water courses. The limestone lowland that extends from Allentown through Reading to Lebanon is a logical place to look for it. No prominent streams run the length of this area, but geologists believe that streams of the past had a prominent part in making the lowland; so remnants of old stream deposits might be there. All of this lowland near Reading, and that part of it within a mile of the railroad lines farther from the city, was examined with care.

No deposits of bank sand were found in this lowland. Furthermore, it is evident that there are none. The proof for this rests on several grounds. In the first place, bedrock is near the surface everywhere. It is astonishing what a luxuriant growth of crops, forest, and grass can exist with solid bedrock only a foot or a few feet below. Numerous quarry holes and railroad cuts consistently show bedrock close to the surface. Any exposed section of the subsurface shows the smooth surface with its soil and vegetation closely underlain by limestone. The top of the limestone is irregular, and the depth of soil and subsoil commonly is 1 to 6 or 8 feet, with occasional spots 10 to 15 feet, depending on the quality of the particular bed of limestone at each spot. See accompanying sketch, Fig. 2. Here and there a quarry or railroad cut shows the cover
above the bedrock not more than 3 feet thick. Cellar holes and other shallow excavations encounter limestone. Still more convincing is the fact that so much limestone outcrops along the roads. Most road cuts and gutters are very shallow, and yet bedrock shows. The obvious conclusion is that if bedrock is so near the surface there is not room enough for a loose deposit of bank sand to be present on top of it. In the second place, the material that rests on the bedrock is a clayey substance with occasional hard angular fragments of chert, siliceous limestone, etc., scattered through it, and with no stratification or layers. The desired bank sand with its stratification and water-worn fragments is a wholly different thing. A third line of evidence proving the absence of bank sand is the type of topography or land form. The forms of water-laid deposits such as bank sand, are quite different from those produced by erosion (wearing away) or solution. Depositional forms are lacking, while erosional and solutinal forms dominate in the area under discussion.

Other places where one might expect deposits of bank sand are along the base and lower slopes of the uplands or hilly areas. It is conceivable that swift streams running off of the uplands might deposit sand and gravel where they slow down on entering the lowland. The field evidence does not bear this out. While it is true that there are patches of material formed this way yet they are scarce and insignificant. The streams are too small and short to have accomplished anything of importance. Several railroad cuts expose the material in these bordering slopes at some length. It is uniformly and unsorted mixture of abundant angular rock fragments in a sandy clay matrix. It is hillside wash, creep, and fan material slowly worked off from the uplands. It thins out rapidly towards the lowland.

Other areas barren of commercial bank sand are along and near the railroad from Birdsboro to Sayles, and from Sinking Springs to Ephrata.

Favorable Areas. There are only two streams of any consequence or size in this region, - the Schuylkill River and its tributary, Maiden Creek. Railroads along these streams make transportation available for any sands found.

Schuylkill Valley. The flat floor is convincing evidence of water-laid deposit. This is a typical valley "fill." It means
that the valley was once deeper but has since been filled up to the level of the present valley flats. The filling has been brought in by the river and its tributaries. Along its whole length small streams and rain wash have gullied the hillsides, sweeping in debris eroded from the slopes. The main stream has moved this farther along and, using the fragments as tools, has in turn deepened and widened its valley. The load has accumulated during the years and constitutes the fill. During this process of transportation and deposition the currents have worked over the material, grinding and sorting it. This produced a layering or stratification, an alternation of silt, sand, and gravel, as the currents varied in strength.

It is clear, then, that wherever there is such a fill there is a chance of commercial sand and gravel. The character, quality, and quantity of the fill must be determined before development is begun, because a fill may not be salable material.

Unfortunately there is little positive evidence about the character of the fill, or its depth. The valley was examined from Pottsville to Roersford. Along this entire stretch only five holes or pits, and only seven wells were found from which records could be gotten. There are many more wells but all of them were put down 25 to 100 years ago, and the present owners know little or nothing about the materials encountered. The records, though scanty, show definitely that sand and gravel are present in this fill. The top material is fine, ranging from a silty fine sand to a sandy loam. Some of it would do for molding sand. It commonly has coarse gravel or cobbles scattered sparingly through it. In two places a few small bowlders were seen. All of these stray pieces are partly worn. This top material is probably 2 to 8 feet thick. Below it are layers of sand and gravel of usable quality. In certain places one would expect to strike layers of a finer texture, such as silt or clay. The deepest section seen was a pit 12 feet deep. This had 3 feet of sandy loam (with a few cobbles here and there) on top and 9 feet of gravel with sand lenses. The sand was used locally. Well records show the presence of sand, in two places or wells so abundant that the hole had to be shored up before it could be deepened.

Another thing must be considered in evaluating the quality of the deposit. Shale is the principal rock in Schuylkill Valley north of Roersford. It is not particularly strong or tough. Sand containing many grains of shale would be of poor quality. The shale south of Reading has a sandy quality. However, in the one deep pit where the material could be seen and handled shale fragments were extremely scarce. This pit is in the fill south of Reading.

The coal contamination in the channel need not be considered a serious menace. It is only a superficial deposit along the present stream and has accumulated only since the start of anthracite mining about 1860. Before the culm was run into the Schuylkill, sand used to be taken from the river bed and used locally for mortar and plaster.

Evidence as to the depth of this fill is meager. One well is reported 28 feet, another 60 feet, a third 70 to 80 feet deep without striking bedrock. A fourth well is given as 186 feet deep but there is some doubt about the record. The other three wells are shallow. One can easily believe that the depth is considerable even if it is not known exactly.
All parts of the Schuylkill Valley are not equally favorable for the recovery of sand and gravel. From a point south of Reading (now Neversink) up to Leesport the valley fill is very narrow, so would not yield large quantities. From Leesport to Hamburg the fill is wide and so more favorable as to quantity. From Hamburg to Pottsville and also on the Little Schuylkill River the flats are narrow. In the other direction, from Neversink to a little below Pottstown the flats are widest; below Pottstown they are narrow again.

On the basis, then, of the size of the deposit only two portions of the river flats are favorable: one from Leesport to Hamburg, the other from Neversink to just below Pottstown. Of these two, the second is much the better chance, partly because of the greater size and partly because freer from possible shale contamination. Any shale pieces supplied in the upper area would have been worn down and carried away by the time the lower area was reached. Specifically, the area from about a mile above Gibraltar and the other between Birdsboro and Honolulu. Several other tracts have medium to large reserves.

It should be borne in mind that no test holes have as yet been put down. Since deep wells are so scarce and their records so poor the properties should be proved both as to quality and depth by digging a number of test holes. Ground water will be encountered within 10 to 15 feet. As water is bound to be abundant and rather near the surface, commercial development will probably depend on suction dredges, or some equipment suitable for working a property where drainage is impracticable. Of course there will be plenty of water for washing.

In many valleys there are terraces of sand and gravel on the sides above the flat bottom. Such terraces are remnants of a once deeper fill which has in larger part been removed by subsequent erosion. There are no high terraces of this sort along the Schuylkill Valley. The high terraces at a few places are either wholly rock terraces or with a veneer of material too thin and clayey to be of any commercial use.

Maclay Creek Valley. This valley is a miniature of the Schuylkill Valley. There are typical valley fills along it, so that here also is a possibility of finding sand and gravel. No pits or well records are available to give evidence as to the character or depth of the fill. The valley was examined up to Traxler. The only place where the width makes the deposits worth considering is from about a mile below Virginville up to Drebelbis. Elsewhere the valley has only a narrow fill that would not be worth considering for a good development. This one tract has as bordering rock a considerable quantity of shale so that some contamination from this source is to be expected. On the whole the possibilities here are not equal in quality to those in the Schuylkill Valley already discussed. On the basis of quantity alone there would be several reserves of medium size, or if the whole tract were worked continuously along the valley a large development can be counted on. One could not expect the depth here to be as great as in the larger valley.

Some sand has been taken from the creek bed for local small jobs. There are no high terraces along the valley. In this respect it is like the Schuylkill Valley.

It should be emphasized again that no test holes have been
put down. They would, of course, be necessary to prove the extent and character of the sand and gravel.

**Minor Sources.** There are several sources of sand which provide small amounts for local use but which will never be adequate for large scale production.

Along many small streams, particularly in the uplands and hilly districts outside of the limestone areas, there are bars or other smaller spots where sand has accumulated. These streams are shallow and there is no great difficulty in digging out enough sand for small jobs of plastering, concrete, etc., around the farm. Such sand is usually clean and suitable for the purpose intended. Sometimes it can be used direct, sometimes it needs to be screened. Occasionally a man gets out loads to sell to the neighbors.

A similar source, though of lesser importance, is the sand that is washed out of roads or gullies by occasional rains rather than by permanent streams.

A rather unusual type of sand occurs several miles east of Kutztown and north of Tipton and Hartstown. In this vicinity there are a number of old mine openings where iron ore was dug 30 or more years ago. The ore is described as "gravel" ore because the fragments of brown hematite were small and had mixed with it a great deal of fkm chert and quartz. In preparing this ore it was screened and washed. The waste from this process constitutes the sand. Several hundred thousand tons of it were piled in the neighborhood of the workings. Most of this has long since been hauled away and used in place of ordinary sand. Little of it is left, and no more is being produced.

**Summary.**

The local sands now in use are all quarry sands not as yet standardized fully enough to satisfy all the trade demands.

Bank sand to supplement the quarry sands is shipped in from New Jersey in large quantities.

The field work was confined largely to a search for bank sand.

The only possibilities for bank sand in the region are along the Schuylkill and Maiden Creek valleys.

The most favorable location is along the Schuylkill between Neversink and Pottstown, the second boat between Locustport and Hamburg. The third choice is along Maiden Creek from below Virginville to Dreibelbis.

The size and character of these deposits is yet to be determined by test holes.